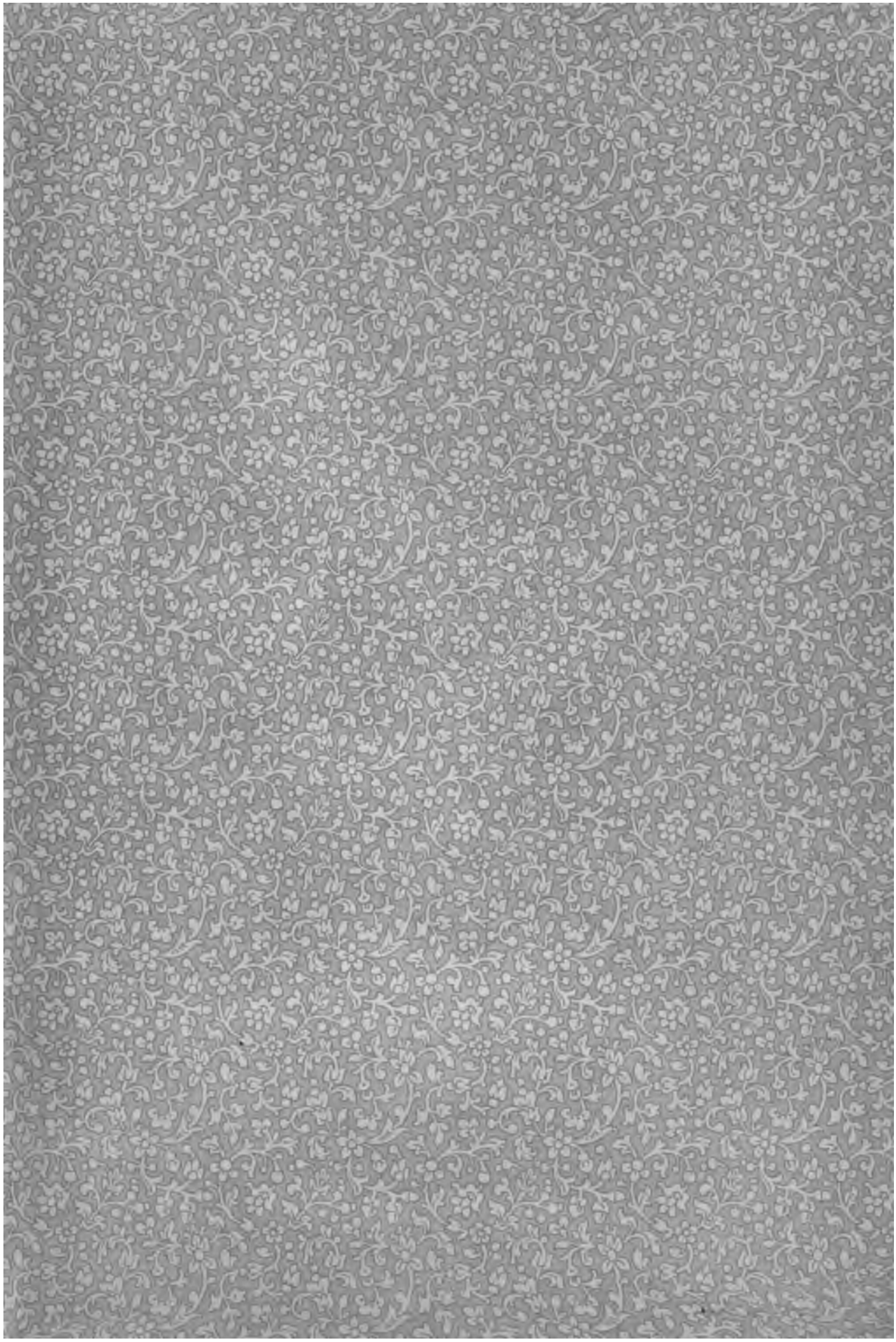
Optische
Werkstaette

CARL ZEISS

Jena.

Microscopes
and
Microscopical
Accessories.

edition. 1898.



CARL ZEISS

OPTICAL WORKS

JENA.

MICROSCOPES

AND

MICROSCOPIC ACCESSORIES.

31st Edition.

1898.

M. 8. X. 98. 3000 e.

Besides this catalogue the following publications may be had gratis on application:

Catalogue of Photo-micrographic and Projection Apparatus.

Appliances for the Projection of transparent and opaque objects.

Catalogue of Photographic Objectives and Photo-optical Appliances.

Catalogue of Optical Measuring Instruments (Refractometers, spherometer, dilatometer etc.).

Price-list of New portable Binocular Telescopes

and descriptions, directions etc. relating to these instruments.

We shall be pleased to forward to applicants a list of other publications relating to objects of our manufacture (Descriptions, Directions etc.) and to microscopy in particular.

Any of the items specified in this catalogue may be supplied singly or in combination with others. The price of a complete microscope and outfit is in all cases obtained by adding together the prices of the individual items as quoted in the catalogue.

The prices are strictly Nett Cash and do not include cost of packing and freight from Jena. Payment may be made by Cash, Cheques or short negotiable English, German or French Bills of Exchange.

Purchasers who have not a regular account with us are requested to send cash with order.

Goods are forwarded, properly insured, at the risk and cost of the consignee. In the absence of special instructions they are despatched by the best and most convenient routes, every precaution being taken to ensure safe and prompt delivery.

We request that the name and address may be plainly written on all orders, and to avoid misunderstandings the edition of the catalogue or the year of publication should be specified.

When ordering by wire it is sufficient to cable the code-words appended to the prices quoted in the catalogue. When ordering several instruments of the same kind it is advisable to telegraph the number desired in words rather than in numbers.

Jena, 1898.

Carl Zeiss,
Optical Works.

Telegraphic address: **Zeiss Werkstaette Jena.**

Branch Offices:
Carl Zeiss, 29 Margaret Street, Regent Street, London W.
Carl Zeiss, Dorotheenstrasse 29 II, Berlin NW.

A selection of complete microscope outfits adapted for a variety of purposes will be found at the end of this catalogue.

We shall be glad to supply for scientific publications electros of the illustrations contained in this catalogue and reductions of several of these.

Contents.

An asterisk denotes that the apparatus or optical combination so marked has originated in our factories, i. e. was either introduced by us as new or, at any rate, first made by us in the form described in the catalogue.

Objectives and Eye-pieces.

In our catalogue No. 28 of 1889, we referred to the progress made at that time, through our efforts, in the practical development of the microscope. This advance was, as we pointed out, in a great measure due to the production of new glasses (Borate and Phosphate-glasses in particular) at the Glass Works of Messrs. SCHOTT & Co., which had been established in Jena, with our cooperation, as the outcome of exhaustive experiments carried out by Dr. SCHOTT and Prof. ABBE. These new glasses possess certain refractive and dispersive properties which render them most valuable materials for the construction of microscope lenses, and the application of new formulae has enabled us, since 1886, to produce objectives possesssing a considerably more perfect correction both of the chromatic and spherical aberrations and consequently to obtain a much greater concentration of light in the image than had hitherto been possible. We introduced simultaneously eye-pieces specially adapted for use with these objectives which, beside possessing other advantages of minor importance, produce almost perfect achromatism and give a sharp image over the whole visual field.

These new combinations were first made known by a special catalogue published in August 1886 and respectively called "Apochromatic Objectives", "Compensating Eye-pieces" and "Projection Eye-pieces" and are now extensively used and appreciated, as numerous comments in various scientific and technical periodicals and works amply testify; they have also fully justified the expectations which they raised as a means of advanced scientific research.

The present catalogue includes, in addition to this new series, most of our older achromatic objectives and ordinary eye-pieces. For although in the more difficult departments of microscopical research the apochromatic lenses are to an increasing extent taking the place of the older objectives, yet there are a great many problems in microscopy that do not demand the highest attainable degree of optical perfection and in the majority of such cases the older "achromatic" microscope will be all that is needful, provided it is good of its kind and thoughtfully and carefully made. The objectives and eye-pieces of the older type have certainly this advantage that, thanks to their much simpler construction, really good lenses of this class can be supplied at considerably lower prices than the lenses of the new series, which are much more complicated and involve in their production an extraordinary degree of manual skill.

On the other hand, the original achromatic objectives have been considerably improved by the use of the new Jena glasses and other suitable modifications. In the higher powers of these lenses, both of the dry and immersion series, the advance thus effected is not inconsiderable. They may therefore, after the example of other makers, appropriately be termed "Semi-apochromatic lenses".

In our supplementary catalogue of 1886 we made our first attempt to introduce a rational system of designation of the objectives and eye-pieces of the new series in place of the prevailing aimless and arbitrary modes of distinction.

Although this system has the claim of greater practical value over the continental custom of distinguishing lenses and eye-pieces by conventional letters or numbers and though in our opinion its universal adoption would decidedly constitute a step in the right direction, yet we deemed it wiser to refrain, for the present, from renaming our older objectives and oculars.

The application of this system to the older series would necessitate great alterations in the focal lengths of both objectives and eye-pieces. Besides, the extensive use of our objectives — manufactured during the last 50 years — has rendered the designations hitherto employed so familiar that any radical alteration in this direction might give rise to considerable confusion.

The construction of all our objectives is based upon a system founded upon complete theoretical computation of all the constructive data previous to actual manufacture. By this system, which was introduced by Prof. ABBE in our Works in 1868, it has become possible to employ, through judicious division of labour and supervision by competent opticians, a large number of persons in the production of lenses of the greatest possible perfection.

Strict mathematical computation of every detail of construction combined with exact technical methods and systematic control of each phase of manufacture obviate all empirical tests. This ensures in the highest as well as in the lowest powers of our lenses an extraordinary degree of uniformity, at the same time altogether excluding those of inferior quality. All objectives are uniformly free from spherical aberration up to the marginal zone (assuming correct thickness of the cover-glass with the higher powers) and as far as possible also from chromatic aberrations. Special consideration is also given to the compensation of the aberrations in the extra-axial part of the field and to the flatness of the image.

Working distance. Owing to the importance of a good working distance for the convenient and safe employment of the higher powers particular attention has been given to this factor in calculating the formulae of the various glasses. Our high power objectives possess therefore unusually large working distances in comparison with their focal length and aperture (see Tables on pp. 18 and 27).

Tube-length. The objectives named in this catalogue are all adjusted for a tube-length of 160 mm ($6^1/_2$ in.), except where the contrary is expressly stated or unless an objective adapted for another tube-length be specially ordered. This length is reckoned from the shoulder of the objective-screw to the upper end of the draw-tube on which the eye-piece rests. It may be directly read off on stands of our make by the divisions on the draw tube. To facilitate adjustment the draw-tubes of our larger stands are furnished with a scale of millimetres.

The interposition of any apparatus between the tube and the objective, such as a revolving nose-piece, sliding objective-changer etc., necessitates the shortening of the tube so as to make the whole distance between the objective-shoulder and eye-piece equal to 160 mm or about $6^1/_2$ in. (see Fig. 1). Similarly, when an ocular fitted with a micrometer casing is being used (such as Nos. 28^a, 28^b, 29^a, 29^b, 30 and 30^a) the height of that part of these instruments which projects beyond the edge of the tube should be taken into consideration.

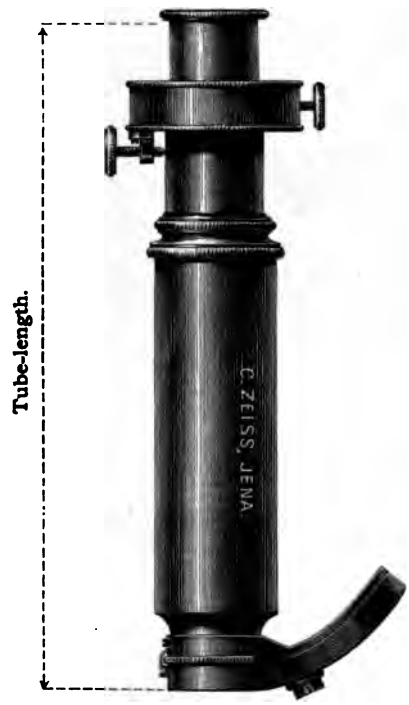


Fig. 1.

Tube fitted with screw-micrometer eye-piece and revolving nose-piece No. 24a.

The distance between the two arrow-points should be 160 mm = $6^1/_2$ in.

($^1/_2$ Full Size.)

The objectives 35 mm, a, aa, A, B and C may without appreciable loss also be used on the large English stands with 8 or 10-inch tubes.

All the other objectives, particularly those of the apochromatic series and also the homogeneous immersion lenses, perform more or less imperfectly on stands of the English type, unless specially adjusted.

In the absence of a statement to the contrary the objectives are adjusted for the short (continental) tube.

Thickness of Cover. All objectives in fixed mounts are, unless otherwise ordered, corrected for a medium thickness of cover between 0.15 and 0.20 mm. In the higher powers (from the apochromatic 8 mm and achromatic D

upwards) that thickness of the cover-glass which gives the most perfect correction is indicated on the side of the mount by small figures representing millimetres. It is, as a rule, sufficient for ordinary work with those objectives which we supply in fixed mounts to use covers of an estimated medium thickness. For very exacting work we recommend the use of a cover-glass gauge (see Nos. 41 and 42).

If it be desired that an objective should be adjusted for a cover-glass differing from the usual thickness this requirement should be specified in the order.

Homogeneous immersion objectives are, within wide limits, independent of the thickness of cover.

Correction adjustment. The divisions and numbers on the correction collar (bb, Fig. 2), which read by a fixed index, indicate directly for each position of the collar that thickness of cover-glass (in hundredths of a millimetre) which gives the best correction corresponding to that position. ***The correction for cover-glass thickness must be carefully adjusted, particularly in the case of the apochromatic objectives 4.0 and 3.0 mm (dry) and 2.5 mm (water-immersion) and the higher achromatic powers, otherwise the efficiency of the lenses will be greatly diminished.***

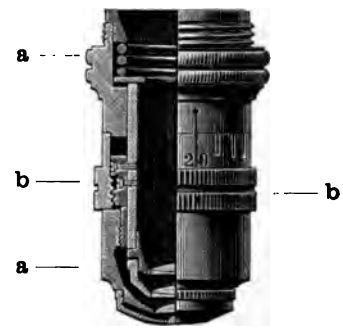


Fig. 2.

Objective fitted with correction-collar.

The correction-ring bb serves to adjust the distance between the two upper double lenses and the two lower lenses attached to the mount aa.

(Full Size.)

The homogeneous immersion objectives are supplied in fixed mounts only, since their efficiency, within rather wide limits, is independent of the thickness of the cover-glass and also because any alteration in the lens distances interferes with the perfection of their correction. Considerable variations in the thickness of the cover-glasses are best compensated for by slightly lengthening the body-tube in the case of excessively thin cover-glasses and by slightly shortening it in that of excessively thick ones.

On page 33 it is shown how the thickness of cover-glasses may in a simple manner be ascertained with the aid of our stands.

As regards the relative merits of the homogeneous and non-homogeneous (water etc.) immersion lenses, the former claim superiority over the latter, focal length and aperture being equal, by reason of their distinctly superior defining power and their

greater insensibility with regard to variations of the thickness of cover-glasses. Water-immersion lenses are to be preferred only in such cases where the nature of the objects does not admit of oil being used as an immersion fluid.

The immersion fluid which we recommend for the homogeneous objectives is Cedar-wood Oil (from Juniperus virginiana) as used by us from the first. We supply the same in a thickened condition, which not only does away with its inconvenient fluidity but at the same time renders its refractive index almost identical with that of the cover-glass. A bottle of this oil is supplied with each objective and may be procured from us on any future occasion (price Mk. 0.75 per $^1/_2$ oz. bott.). We expressly caution all against the use, with our lenses, of immersion fluids derived from other sources or of such as have not been carefully tested as to their proper refractive power, as is done by us, since the use of unsuitable fluids entails considerable loss in the optical performance of the objective together with some risk of penetration of the oil within the objective.

Fig. 3a.
Cap-bottle for Immersion-oil.
($^1/_2$ Full Size.)

For the convenient use of the immersion-oil we recommend either the **Bottle with cap and rod** shown in Fig. 3a (Price each **Mk. 1.—**. Code-word: **Baalita**) or L. MACH's **Conical Bottle,** which is so arranged that the oil cannot flow out in the event of the bottle being upset or tilted, while in actual use it is very economical (see Zeitschrift f. wiss. Mikrosk., Vol. 14, p. 348, 1897). (Price **Mk. 1.50**. Code-word: **Babada.**)

Fig. 3b.
Conical Oil-bottle.
($^1/_2$ Full Size.)

The expression **"Numerical Aperture"** (*num. ap.*) or shortly Aperture in this catalogue is used throughout in the sense in which it was introduced in 1873 by Prof. ABBE on the basis of his theoretical investigations. Accordingly, it represents the ratio between the radius of the effective aperture *(p)* of the system on the side where the image is formed — more accurately the radius of the emerging pencils measured in the upper focal plane of the objective — and the equivalent focal length *f* of the latter, i. e.

$$num.\ Ap. = \frac{p}{f}.$$

This ratio is equal to the product of the sine of half the angle of aperture u of the incident pencils and the refractive index n of the medium situated in front of the objective. With dry lenses n has, therefore the value 1; with immersion lenses it is equal to the refractive index of the particular immersion fluid.

$$num.\ Ap. = n.\ sin\ u.$$

The numerical aperture of a lens determines all its essential qualities: The brightness of the image increases with a given magnification, other things being equal, as the square of the aperture; the resolving and defining powers are directly proportional to it, the focal depth (differentiation of depths) varies inversely as the aperture, and so forth. For details on this subject see ABBE on "The estimation of aperture". Journ. Roy. Micr. Soc. Ser. 2, Vol. I, 1881, p. 388—423 und CZAPSKI, Theorie der optischen Instrumente, Breslau 1893, p. 224.

The mounts of all objectives are provided with the **English standard screw** of about 20 mm ($^3/_4$ ") external diameter. In the series from A to J, however, and also DD, when not fitted with correction adjustment, the lower part of the mount containing the lenses is made to unscrew from the adapter and may then be used with the narrow-gauge thread.

The name of our firm is engraved on the mounts of all our objectives; on the apochromatic objectives are further engraved the aperture, focal length and tube length for which they are adjusted and on the achromatic lenses the letter by which they are distinguished.

When ordering objectives which are intended for use with stands not made by us it is advisable to send the tube in question for the purpose of adapting the objectives and eye-pieces in all cases where it is not definitely known whether the screw-thread and the internal diameter of the tube are the same.

*Apochromatic Objectives.

We cannot here do more than briefly describe the essential features of the apochromatic lenses and must refer those who would wish to pursue the subject further to the paper of Prof. ABBE, entitled "Ueber Verbesserungen des Mikroskops mit Hilfe neuer Arten optischen Glases" (Sitzungsberichte der Med.-naturw. Gesellschaft zu Jena, 9. July 1886) [1]) and to the work of our colleague Dr. CZAPSKI on the "Theorie der optischen Instrumente nach ABBE" (Breslau 1893, TREWENDT), which jointly furnish a complete exposition of the scientific aims and principles which govern the construction of the apochromatic lenses.

These objectives differ essentially from all other microscopic lenses previously constructed by the simultaneous realisation of two conditions which hitherto had not been fulfilled by any other optical combination viz: 1) the union of three different colours of the spectrum in one point of the axis, that is to say, the elimination of the so-called secondary spectrum left uncorrected in the older achromatic lenses, and 2) the correction of the spherical aberration for two different colours, in contradistinction to the usual correction for one colour in the brightest region of the spectrum only.

With all optical systems constructed up to 1886, the microscope included, the greatest sharpness of the image is limited to one particular colour of the light transmitted (i. e. green-yellow in the case of lenses used for ocular observation, blue-violet in photographic lenses) while the other rays give more or less confused images, appearing partly as colour fringes surrounding the sharpest image and partly as a general haze spread over the whole field. With the apochromatic lenses, however, the images are for all colours of the spectrum nearly equally sharp. The quality of the image is, therefore, independent of the nature of the illuminating source, which may be white or compound, monochromatic or photo-chemically active light emerging from any narrow or wide section of the spectrum.

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[1]) sent gratis on application.

Again, in the older series complete colour correction is obtained for one zone of the objective only, a marked deterioration being observable towards the margin and the centre of the aperture, whilst in the apochromatic lenses the chromatic aberrations are corrected uniformly for all zones. Consequently, in using ABBE's test plate, scarcely any more colour is perceived with the most oblique illumination than with semi-lateral or central light.

Finally, with the achromatic lenses even within the zone of the most complete colour correction only two colours can be united in one point. The various coloured images can therefore fall on the same spot in pairs only between which there is a considerable difference of focus. In the new series, however, three colours are brought to a focus, whereby the focal differences of the various sections of the spectrum, from the visible to far into the chemically active portion, are reduced to fractions varying from 1/7 to 1/10 of their original magnitude, i. e. they are practically eliminated, and this, as has been stated before, is done in equal degrees for all zones of the objective. The images due to each single colour, thus individually corrected, are rendered perfectly coincident and collectively form the final image[1]).

The practical advantages of these new lenses are obvious. Their considerably increased power of concentrating the light with ordinary eye-piece observation or with any other mode of application under all possible conditions of illumination establishes their acknowledged superiority over the ordinary achromatic lenses, both with respect to optical power and diversity of application.

The natural colours of objects, even delicate differences of tint, are reproduced faithfully by these objectives. Close to the margin of the field, the images are nearly as sharp as they are in the centre.

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[1]) It is incorrect, both theoretically and practically, to regard this achromatisation of a higher order, as here defined, as a mere improvement of ordinary "achromatism", such as would result from a diminution of the secondary spectrum while yet only two colours are united, or from achromatisation embodying the principles here indicated but limited to one particular zone of the objective, which might be obtained by the introduction of suitable glasses in objectives constructed after the usual formulae. The word "apochromatic" was introduced by Prof. ABBE as a technical term for this other kind of achromatism, long familiar to scientists as a theoretical idea but only recently realized practically. In order to avoid ambiguity it is desirable that this expression thus clearly defined by its author should retain its original meaning, and any attempt to utilize it for purposes of trade advertisement should be discountenanced.

Just as in the older lenses a slight degree of curvature of the image cannot be avoided in these objectives owing to their high apertures and comparatively great working distances. The central and marginal portions of the field do, therefore, not appear sharply in focus simultaneously, but have to be focussed in succession by means of the micrometer screw.

As a result of their great light-gathering power these objectives admit of the use of very high power eye-pieces without detriment to the precision or brightness of the image, thus giving high magnifying powers with relatively long focal lengths and yielding with one objective an extensive series of magnifications.

The list on p. 14 shows beside the apertures and foci the corresponding initial magnification, i. e. the magnification which the objective alone would give at the distance of distinct vision if used as a single lens. This is simply 250 (distance of distinct vision) divided by the focal length of the objective in mm. For instance, the initial magnification of a 3 mm objective is:

$$\frac{250}{3} = 83.3.$$

The apertures indicated are the guaranteed minimum values; the stated focal lengths are adhered to as closely as possible.

In reply to numerous enquiries and, in some cases, publicly expressed doubts respecting the

Durability of the apochromatic lenses

we would make the following statements:

All glasses used in the construction of our apochromatic lenses have been amply tested by several years experience and offer a fair guarantee for their permanency, at all events as long as the lenses are not exposed to exceptionally unfavourable conditions.

Our new Apochromatic Objectives are quite as permanent as the Achromatic Lenses.

A few isolated cases have occurred, even in our climate, in which one or the other of the constituent lenses of certain objectives have become cloudy; but it would not be fair to hold us responsible for such contingencies. It should be remembered that the introduction of the new series of lenses by us necessitated the application of entirely new materials which, until then, had not been used or tested. The first lenses, necessarily, lacked the kindly aid of experience and it is not surprising that a few failures should have occurred.

In all cases where one of the lenses of an objective supplied by us should exhibit spontaneous changes we shall not hesitate to repair the damage at our cost by substituting a fresh lens made of a glass which experience has proved to be permanent. To this promise we attach however the condition that the objective in question be sent to us previous to any attempt being made in this direction by others. In no case should such an objective be dismounted, with a view to clean it, by any other but an expert, since any such interference by inexperienced hands might suffice to convert a slight irregularity, that could be easily corrected by us, into a serious or even irreparable defect.

Remarks on the use of the 2 mm Apochromatic Lens of 1.40 num. aperture (homogeneous immersion).

Owing both to the hyper-hemispherical form of the front lens, which is held in position by a very narrow ridge at the extreme edge of the setting, as shown in Fig. 4, left side, and its relatively short working distance (0.2 mm) this lens demands careful treatment, and shocks or pressure should be scrupulously guarded against. As compared with the 2 mm lens of 1.30 aperture this objective possesses a greater resolving and defining power in the proportion of 14:13 (8%) and gives a brighter image in the proportion of 20:17 (14%). We recommend the 2 mm, 1.40 in such cases where it is desirable to reach, without the restrictions imposed by our 2.5 mm Ap. 1.60 (monobromide of naphtalin immersion), the utmost limits of microscopic vision and also in such cases where the lens is to serve as a means of controlling observations made with lower powers; for regular work preference should be given, generally speaking, to the 2 mm 1.30, owing to the greater firmness of the front-lens.

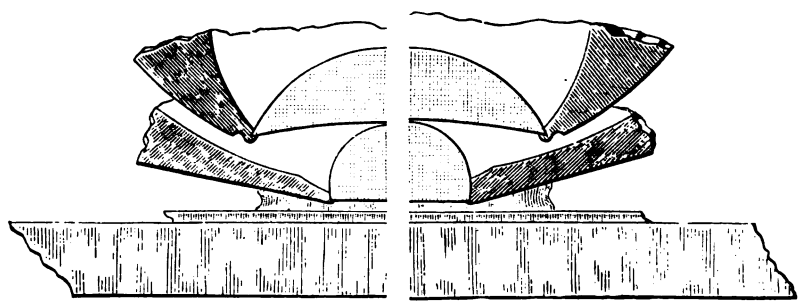


Fig. 4.
Longitudinal section of the lower point of the lens together with the object (scale 10:1).
The left side represents the apochromatic 2 mm, Ap. 1.40 showing the front-lens held by the lower ridge only; the right side represents the apochromatic 2 mm Ap. 1.30 showing the relatively much wider setting.

The objective 3 mm, 1.40 apert. has over the 2 mm, 1.40 the decided advantage of possessing the same optical capacity and a greater working distance and of being also less delicate mechanically.

The **Apochromatic lenses of relatively short focus** (3 mm Ap. 0.95, dry and 1.5 mm, Ap. 1.30, homog. Immersion), owing to their relatively high initial magnification, are not generally adapted for use with the highest eye-pieces and with all feebly differentiated objects the ocular used should, as a rule, not be higher than No. 8.

The **Objective 2.5 mm, Aperture 1.60 (Monobromide of Naphtalin Immersion),** which we included in previous catalogues, has hitherto been used successfully for the examination of diatomaceae only, no mounting medium having as yet been found possessed of a sufficiently high refractive index which can be used for mounting other organisms without destroying their structure or colour. A detailed account of the constructive principles, the application and optical powers of this lens may be seen in the Zeitschr. f. wiss. Mikroskopie, Vol. 6, p. 417, 1889; Journ. of the Roy. Microscop. Soc. 1890, p. 11, and H. VAN HEURCK, La nouvelle combinaison optique de M. ZEISS et la structure de la valve des diatomées, Anvers 1890.

The **Lenses** of **35** and **70 mm** focus serve exclusively for photo-micrography and projection. The latter can only be used in conjunction with the photo-micrographic stand, the former, however, may be used with any of the other stands.

Fig. 5.
Projection-lens of 35 mm focus together with the tube and object shown in focus.
($^1/_2$ size.)

The **35 mm lens** screws, like other lenses, to the lower end of the tube in the usual manner (Fig. 5).

The **70 mm lens** screws by means of a special conical adapter into the upper end of the microscope body in the place of the ordinary draw-tube, which must be removed (Fig. 6).

Fig. 6.
Projection-lens of 70 mm focus together with conical adapter screwed into ocular end of the tube, with the object shown in focus.
($^1/_2$ size.)

	Price:	Code-word:
Projection-Lens of 35 mm Focus	**M. 35.—**	**Babadero.**
„ „ „ 70 „ „	**M. 40.—**	**Babahol.**

Recently we have constructed a new form of Projection-Lens, the so-called **Planars**, which serve the same purposes as the Projection-Lenses just described but possess a considerably larger, flatter, sharper and brighter field. Owing to their complicated form they are necessarily more costly than the other Projection-Lenses.

The following is a list of our Micro-Planars as made and recommended by us for photo-micrography and projection:

Micro-Planars.

Series and No.	Equivalent Focus		Diameter of Lenses		Largest relative Aperture	Size of Plate covered		Diameter of image, with small stops	Angle	Lens in Brass Mount fitted with Iris-Diaphragm		
						at full aperture	with intermediate stops			in Standard Mount	Price	Code-word
	mm	in.	mm	in.	*F*	in.	in.	in.	Degrees	No.	M.	
I^a, 1	20	$^3/_4$	5	$^1/_4$	4.5	$^1/_2 \times ^1/_2$	$^3/_4 \times ^3/_4$	1	65	0	**100**	**Placage**
I^a, 2	35	$1^3/_8$	9	$^3/_8$	4.5	$^7/_8 \times ^7/_8$	$1^1/_4 \times 1^1/_8$	$1^3/_4$	65	0	**100**	**Placard**
I^a, 3	50	2	12	$^1/_2$	4.5	$1^1/_4 \times 1^1/_8$	$1^3/_4 \times 1^3/_4$	$2^1/_2$	65	I	**100**	**Placenta**
I^a, 4	75	3	17	$^3/_4$	4.5	$1^5/_8 \times 1^1/_2$	$2^3/_8 \times 2^3/_8$	$3^3/_4$	65	II	**120**	**Placet**

Nos. 1 and 2 of the Planars are fitted with the Royal Microscopical Society's Screw. Nos. 3 and 4 are provided with special adapters to be screwed into the wide tube of the photo-micrographic stand. In order to obtain the full advantage of the very large field of view, all these numbers should be used with a wide tube, while those of greater focal length may also be screwed direct to the camera. For further particulars consult our separate list of Planars.

All these objectives are used without eye-pieces.

As a condenser it is best to use a convex lens of suitable focus for concentrating the rays of the source of light upon the objective, so as to make the pencil of rays emerging from this lens pass through the object before coming to a focus.

The amplifications obtainable with these lenses may be calculated by dividing the distance of the image, i. e. of the focussing-screen, from the objective by its focal length, and deducting 1 from the quotient so obtained according to the well known formula:

$$N = \frac{b}{f} - 1.$$

List of the Apochromatic Objectives.

	Numerical Aperture	Equivalent Focus in mm	Initial Magnification	Price Marks	Code-words
Dry Series	0.30	24.0*	10.5	120.—	**Babirusa**
		16.0	15.5	80.—	**Baballeon**
	0.65	12.0*	21	140.—	**Babor**
		8.0	31	100.—	**Babanca**
	0.95	6.0*	42	180.—	**Babosa**
		4.0	63	140.—	**Babatel**
		3.0	83	160.— with corr. collar.	**Babaza**
Water Immersion	1.25	2.5	100	250.— with corr. collar.	**Babazorro**
Homogeneous Immersion	1.30	3.0	83	300.—	**Babequia**
		2.0	125	300.—	**Babera**
		1.5	167	350.—	**Babicha**
	1.40	3.0	83	400.—	**Babilonia**
		2.0	125	400.—	**Babilla**

* ***The three objectives 24 mm, 12 mm and 6 mm of the dry series are constructed exclusively for the 10 inch tube, all the others are adjusted either for the continental or English tube.***

* Compensating Eye-pieces.

All objectives of considerable aperture, from their peculiar construction (hemispherical front-lens), exhibit certain colour defects in the extra-axial portion of the visual field (chromatic difference of magnification), even if perfectly achromatic in the centre. The differently coloured elementary images which combine to form the final image (DIPPEL, Das Mikroskop, 2nd Ed., Brunswick 1882, p. 225; CZAPSKI, Theorie d. opt. Instr. p. 135) are of different magnitudes, the blue image being larger than the red. Whether an image be directly projected by such an objective or whether it be examined with an eye-piece (even of the achromatic or so-called aplanatic type) colour fringes will be observed, increasing towards the margin of the field.

This peculiarity is also shared by the higher apochromatic objectives, and to the lower powers it has been intentionally imparted to a similar degree, a means being thereby obtained of almost entirely eliminating this error with the aid of suitable eye-pieces. The latter are made to possess an equivalent error of the opposite sign, that is, the image formed by the red rays is larger than that corresponding to the blue rays. Such eye-pieces serve therefore to compensate the unequal magnification of different colours and the images appear free from colour up to the margin of the field.

This compensatory property of the eye-pieces is rendered apparent particularly in the higher numbers where the limiting diaphragm is placed outside the lenses, by the fact that the edge of this diaphragm shows a red border, whilst the image of the object formed at this very edge of the diaphragm is perfectly colourless.

The mounts of the eye-pieces are such that the lower focal points of all the numbers of each series lie in the same plane when the eye-pieces are inserted in the body-tube (see Fig. 7). No alteration of focus is therefore required on changing the eye-piece, and the "optical tube length" (DIPPEL, l. c. p. 188), i. e. the distance between the upper focal point of the objective and the lower of the eye-piece, which is the determining element of the magnifying power, remains constant. — In the continental microscopes this tube-length is 180 mm, irrespect-

ive of small differences between the various objectives, the length of the body, from the screw-collar of the objective to the upper end of the tube on which the eye-pieces rest, being 160 mm (see pp. 3 and 4).

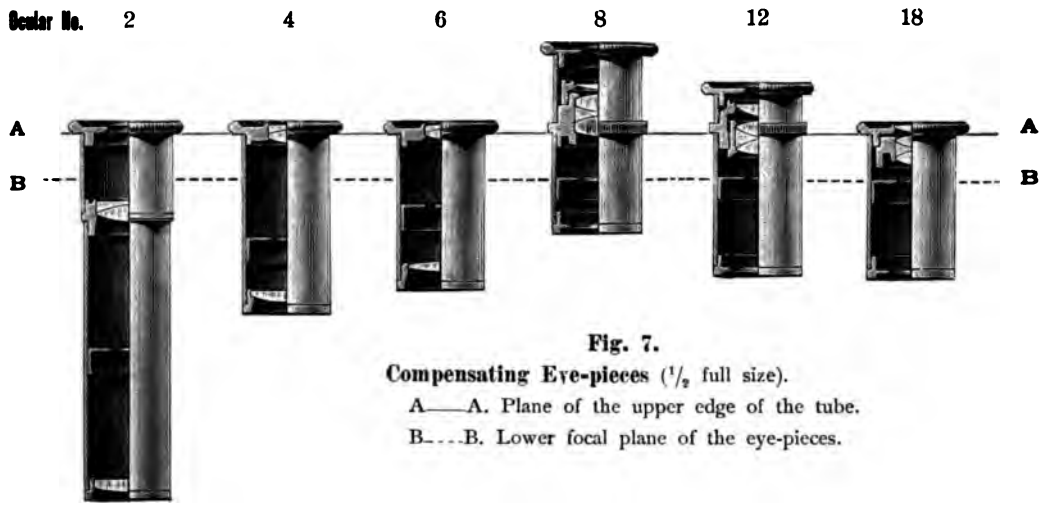


Fig. 7.
Compensating Eye-pieces ($^1/_2$ full size).
A——A. Plane of the upper edge of the tube.
B- - -B. Lower focal plane of the eye-pieces.

The numeration of these eye-pieces is carried out on the plan proposed by Prof. ABBE. Accordingly, the number which denotes how many times an eye-piece, when used with a given tube-length, increases the initial magnifying power of the objective affords a correct measure of the eye-piece magnification and, at the same time, furnishes the figures for their rational numeration. In this way our compensating eye-pieces are numbered according to their magnifying powers, viz: (1), 2, 4, 6, 8, 12, 18, (27).

The magnification obtained by the combination of a compensating eye-piece with any apochromatic objective is found by multiplying its number by the initial magnification of the objective as given in the table on p. 14. An objective of 3.0 mm focus, for example, yields in itself a magnification of 83.3 (calculated for the conventional distance of vision of 250 mm); eye-piece 12 in conjunction with this objective gives therefore a magnification of $12 \times 83.3 = 1000$ diameters.

The very low power eye-pieces are known as **Searchers** and serve the purpose of obtaining the lowest possible magnification with any objective, so as to facilitate preliminary examination and the process of searching for particular points with high powers. They are particularly useful with immersion objectives, where great inconvenience is caused by having to change a lens already adjusted for another of lower power.

The No. 1 Searcher Eye-piece is somewhat inconvenient to handle owing to its great length, and in consequence of the limitation imposed by the usual size of our draw-tube, its field is no greater than that of Eye-piece 2. For these reasons we make Eye-piece 1 to order only, its price being **Marks 20.—**. Code-word: **Baboso.**

The **Working Eye-pieces** are for regular observation and vary in magnifying power from 4 upwards. They are likewise of an entirely new form, and even their highest powers can be used without discomfort. In all these eye-pieces the eye-point has been placed at such a height as to completely obviate the inconveniences formerly attending the use of eye-pieces of short focus.

Nevertheless it is advisable to reserve the highest eye-pieces, 12 and 18, for use in combination with the lower power apochromatic objectives of 16 and 8 mm focus.

Fig. 8.
Compensating Eye-piece 4* with iris-diaphragm.
($^1/_2$ full size.)

The narrow diameter of the draw-tubes of the microscope-stands affords but little play for increasing the size of the eye-piece lenses. Since the latter governs the size of the field it follows that in the case of the long focus eye-pieces the field is smaller than need be for any optical reason. On the other hand, a large field is a particularly desirable feature in low power eye-pieces, their primary object being to cover as wide an area as possible. To meet this requirement we have recently modified one of the eye-pieces of the compensating series (as well as one of the series of the Projection and Huyghenian eye-pieces) in such a manner as to make its **field half as large again** as that of the ordinary compensating Eye-piece 4, the new wide-field eye-piece being distinguished by the designation **Compensating Eye-piece 4***. To use this eye-piece the draw-tube with the sliding sleeve should be unscrewed from the body of the microscope and Eye-piece 4* **screwed on** in its place. It is fitted with a revolving collar and can be fixed in any desired position by means of a set-screw *K*. The ordinary fixed diaphragm is replaced by an iris-diaphragm, by means of which the size of the field may be varied at will, frequently a great convenience in demonstrations. The eye-lens is mounted an a sliding sleeve after the manner of the micrometer eye-pieces, adapting it for use with a scale or pointer etc. when desired.

Compensating Eye-piece 4* can be used together with our drawing apparatus No. 44a. No advantage is, however, to be derived from the increased size of the field except when the eye-piece is used in conjunction with the low power objectives, not above 8 mm, as the field of the higher objectives is not sufficiently large to satisfactorily fill the field of the eye-piece.

Micrometers for these eye-pieces and micrometer eye-pieces are described under Nos. 27 et seq.

List of Compensating Eye-pieces.

	Searcher Eye-piece	Working Eye-pieces						
Eye-piece No.:	2	4	4*	6	8	12	18	27
Equivalent focal length in mm	90	45	45	30	22.5	15	10	—
Price: Marks	20	20	40	20	30	30	25	—
Code-word:	Babucha	Babuino	Babosuelo	Bacado	Bacana	Bacaptal	Bacara	—
	For the English tube:							
Equivalent focal length in mm	135	67	—	—	34	22.5	15	10
Price: Marks	25	25	—	—	35	30	30	25
Code-word:	Buscar	Buso	Bustice	Butaca	Butiro	Butua	Buz	Buzero

When ordering eye-pieces for stands which are not of our make it is necessary to send us an exact impression in sealing-wax of the tube edge. It is still better to send us the actual tube which the eye-pieces are to fit.

Table of Magnifications of the Apochromatic Objectives with the Compensating Eye-pieces

calculated for an image distance of 250 mm = 10 in.

Focus of the objective	Searcher Eye-piece	Working Eye-pieces					
	2	4	6	8	12	18	27
24.0	21	42	—	83	125	187	281
16.0	31	62	94	125	187	281	—
12.0	42	83	—	167	250	375	562
8.0	62	125	187	250	375	562	—
6.0	83	167	—	333	500	750	1125
4.0	125	250	372	500	750	1125	—
3.0	167	333	498	667	1000	1500	—
2.5	200	400	600	800	1200	1800	—
2.0	250	500	750	1000	1500	2250	—
1.5	333	667	1000	1334	2000	3000	—

It is advisable to reserve the high power eye-pieces 12 and 18 for use in conjunction with the apochromatic objectives of 16 and 8 mm focus.

Table of the free working distance and the diameter of the area of the object

obtained with the Apochromatic Lenses in conjunction with Compensating Eye-piece 4

(with a tube-length of 160 mm).

	Focus mm	Free Working Distance mm	Diameter of area of object mm
Dry lens	**16.0**	**5.0**	**2.0**
„	**8.0**	**1.0**	**1.0**
„	**4.0**	**0.2**	**0.45**
„	**3.0**	**0.15**	**0.35**
Water Immersion	**2.5**	**0.13**	**0.25**
Homog. Immersion	**3.0**	**0.16**	**0.35**
„	**2.0**	**0.14**	**0.25**
„	**1.5**	**0.09**	**0.20**

By **free working distance** as specified in this table is to be understood the distance in millimetres between the upper surface of a cover-glass 0.15 mm thick and the lower surface of the lens mount, the lens being focussed for an object situated at the lower surface of the cover-glass. This quantity depends, of course, upon the mount of the front lens and varies, therefore, slightly. The values given above are, therefore, only approximate, especially in the case of the higher powers (i. e. those of short focus).

The **diameter of the area of the object** indicates, in absolute measure, the size of the object seen with the Compensation Eye-piece 4, but these values also vary since the diaphragms of the eye-pieces are not perfectly constant.

Ehrlich's Stops No. 32[a] serve to reduce the field of view to a definite measure.

*Projection Eye-pieces.

These are used for projecting the image formed by the objective upon a screen (for demonstrating) or photographic plate. They consist of a collective lens and a compound system (see fig. 9). The latter is most carefully corrected, both spherically and chromatically, after the principle of the apochromatic lenses and, is, in particular, entirely free from secondary chromatic aberration and from difference of focus of the visual and chemical rays.

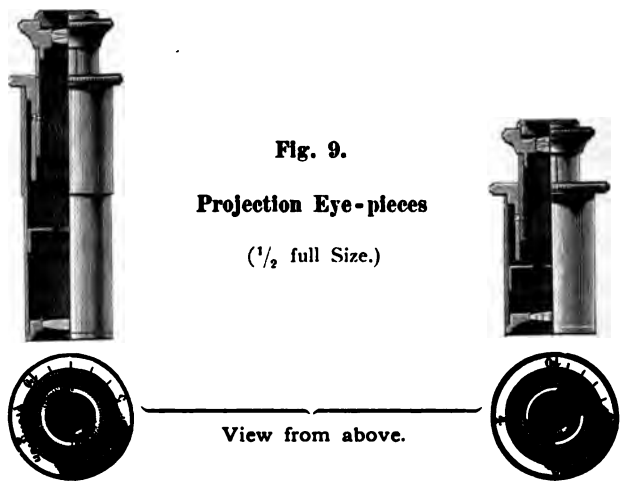


Fig. 9.

Projection Eye-pieces

($^1/_2$ full Size.)

A diaphragm is placed between these lenses so as to limit the field, and the distance between this diaphragm and the compound lens can be varied. The cap of the projection eye-piece forms a diaphragm which entirely obviates internal reflection in the body-tube. The aperture of this diaphragm is made to correspond with the greatest aperture of the apochromatic lenses.

The projection eye-pieces are specially corrected for our apochromatic lenses on the principle of the compensating eye-pieces, but may, nevertheless, be employed advantageously with ordinary achromatic lenses of large aperture, say from DD upwards.

The designation of these eye-pieces denotes, as in the case of the other compensating eye-pieces, the magnifications which they would yield if used for ocular observation, the magnifications being also measured after the same principle as those of the compensating eye-pieces.

The magnifications are **2** and **4** for the 160 mm tube, **3** and **6** for the 250 mm (10") tube.

We do not make Projection Eye-pieces of higher power than those specified since they would not possess any practical advantage over the ordinary compensating eye-pieces. The latter should therefore be used when higher magnifications are required.

The same considerations which led to the construction of Compensating Eye-piece 4* (and the HUYGHENIAN Eye-piece 2*) have recently prompted us to make a **Projection Eye-piece 2*,** which possesses a considerably **larger field** as compared with the ordinary Projection Eye-piece 2. It is fitted with an iris-diaphragm in the place of the ordinary stop and, like our Compensating Eye-piece 4*, screws to the body of the microscope, from which the draw-tube is detached for this purpose.

When ordering, describe the stand on which this eye-piece is to be used, also state whether the stand is fitted with an objective-changer and describe the nature of the latter (revolving or sliding changer).

Projection Eye-piece 2* possesses special advantages for projection only, where the increase of the field of view facilitates general examination of the object. As a photomicrographic eye-piece it possesses no particular advantages over the ordinary projection eye-pieces since that part of the field which is sufficiently sharp for photo-micrographic purposes is no greater than the field of the ordinary projection eye-piece.

The magnification obtained at a certain distance of the image from the eye-piece is found by dividing this distance, expressed in millimetres, by the focal length of the objective used and multiplying the result by the number of the projection eye-piece employed. — Thus the objective of 3 mm focus with the projection eye-piece 2 at a distance of 1500 mm gives an image magnified 1000 times $\left(\text{since } \frac{1500}{3} \times 2 = 1000\right)$.

Strictly speaking, this rule holds good for long distances only; for short distances the number so obtained is in excess of the true value.

The screen distance may in the case of Projection Eye-pieces 2 and 3 be reduced to about 200 mm and with 4 and 6 to about 120 mm (reckoned from the eye-piece); it may, however, be increased to any desired length.

The **linear diameter of the image** corresponding to a screen-distance of 1 metre from the cap of the ocular is

with Projection eye-piece	2	. .	about	200 mm	= 8	in.
„ „ „	2*	. .	„	420 „	= 16½	„ (at full aperture)
„ „ „	3	. .	„	300 „	= 12	„
„ „ „	4	. .	„	300 „	= 12	„
„ „ „	6	. .	„	400 „	= 16	„

At other distances it is proportionately greater or less.

Price of Projection Eye-piece 2 Marks 40.— Code-word: **Baciga**
„ „ „ „ **2*** „ **60.**— „ **Baclnera**
„ „ „ „ **4** „ **40.**— „ **Bacoben**

The description of a micrometer specially adapted for projection eye-pieces will be found under the heading "Measuring Appliances", article No. 110, PLAGGE's micrometer for projection eye-pieces.

Achromatic objectives.

Respecting the general character of these objectives we refer to the remarks on pages 2 to 7.

Aided by the considerably extended list of materials produced by the Jena Glass Works we have reconstructed most of the older types of achromatic lenses so as to eliminate imperfections due to spherical and chromatic aberration more completely than had formerly been possible. With the higher dry lenses DD, E and F this improvement, apart from the clearer appearance of the image, is externally manifested by the increased sensibility of the lenses with regard to differences in the thickness of the cover-glass and length of tube. These differences are therefore now of even greater moment than formerly.

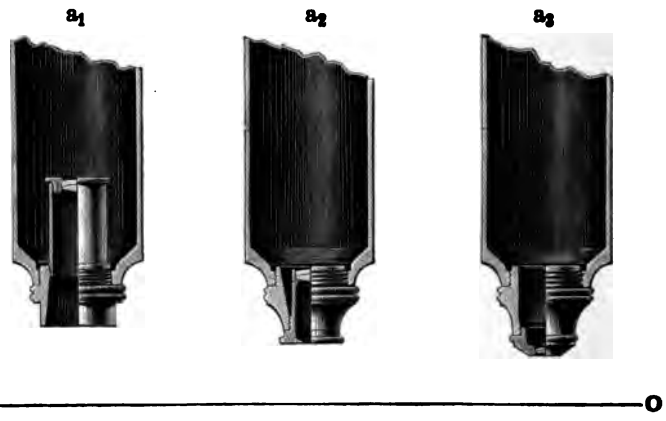


Fig. 10.

Objectives a_1, a_2, a_3 attached to the tube and focussed with respect to the plane of the object OO.

($^1/_2$ full size.)

The **Objectives a,** Fig. 10, are simple achromatic lenses, so mounted that notwithstanding their great focal length, the body of the microscope remains at its ordinary elevation during observation. Lens a_1 has its thread so placed that when screwed into the tube, the lens is inside the body (see Fig. 10 a_1); it cannot therefore, be used with a revolving nose-piece or other objective-changer. These objectives are only intended for use with the lower eye-pieces.

Objective a* (Fig. 11) consists of two achromatic lenses combined after an original formula. By means of a ring *RR* rotating like a correction-collar the distance between the two lenses can be varied, whereby, with a lower eye-piece, the magnification can be gradually raised until it becomes nearly doubled. This power of varying the magnification is obviously useful for many purposes.

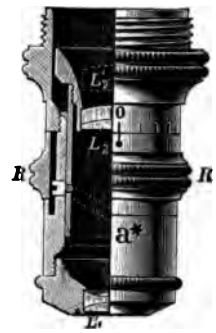


Fig. 11. Objective a*.
By rotation of the ring *RR* the upper pair of lenses (L_2) may be moved into its uppermost position as indicated by the dotted lines (L_2').
(Full Size.)

To the achromatic lenses enumerated in our former catalogue we have added, in 1890 at the suggestion of Mr. BRATUSCHECK, a water-immersion lens of great focal length but having a relatively small averture, viz. **Objective D*.** This objective facilitates the examination at intermediate magnifications (200 to 500 diameters) of living zoophytes and plants floating in water-troughs. Its great working distance gives to the microscopist a relatively wide range in following the motions of these living objects. The objective being constructed on the water-immersion principle, i. e. there being always a layer of water interposed between the objective and the cover-glass, the correction of the aberration will not be affected by focussing at various depths of the water-cell, as a diminution of the stratum of water under the cover-glass always corresponds to an increase of the stratum of the water above the cover-glass, and *vice-versâ*. This manner of using the lens consequently does not interfere with the quality of the image. The relatively small aperture is the necessary outcome of the great working distance. For the particular kind of observation for which the lens is mainly designed this fact constitutes an advantage rather than a disadvantage owing to the resulting increased depth of vision.

The lens may be used with or without cover-glass and gives equally good images with fresh and sea water.

The magnifications obtained with this objective in conjunction with the HUYGHENIAN eye-pieces are the same as in the case of the D and DD; when used in combination with the compensating eye-pieces it gives nearly the same magnifications as the 4 mm apochromatic lens of 0.95 aperture (about 9 % less).

The **Plankton-Searcher,** an optical combination recently devised by our Dr. HARTING, serves essentially the same purposes as the D* objective. It is a water immersion objective principally adapted for low magnifications and though its aperture is 0.11 its working distance is as much as 36 mm. Its optical properties (magnification and size of field, are very similar to those of

the dry lens aa. The depth of vision is equally considerable in both forms. New glasses capable of resisting the influence of the water have been used in the construction of these lenses and the optical correction is almost of the aprochromatic order. This objective is eminently adapted for demonstrating and teaching purposes.

Regarding the **use of achromatic objectives in conjunction with compensating eye-pieces** it will be well to state here that the achromatic objectives from DD upwards, i. e. only those having relatively large apertures, should be used in that manner. With those of small apertures the use of compensating eye-pieces gives rise to similar errors (though of the inverse chromatic order of succession) in the achromatism of the margin of the field to those effected when apochromatic lenses are used in conjunction with the ordinary HUYGHENIAN eye-pieces.

All these objectives are also supplied adjusted for the English 8 and 10 inch body and in the English form of mount.

Fig. 12.
Mahogany case for objectives and eye-pieces.

Separate mahogany cases for objectives, with lock (Fig. 12), according to size Marks 7 to 30.—.

List of Achromatic Objectives.

	Designation	Numerical aperture	Equivalent focal length	Price in Marks without Correction-Collar	Price in Marks with Correction-Collar	Code-words
Dry-Series	a_1	—	40 mm ($1^9/_{16}$")	12.—		**Baconar**
„ „	a_2	—	35 mm ($1^3/_8$")	12.—		**Baconista**
„ „	a_3	—	30 mm ($1^1/_4$")	12.—		**Bacora**
„ „	a*	—	38—26 mm ($1^1/_2$"—1")	40.—		**Baculo**
„ „	aa	0.17	26 mm (1")	27.—		**Bachebo**
„ „	A	0.20	18 mm ($^3/_4$")	24.—		**Bachillera**
„ „	AA	0.30	18 mm ($^3/_4$")	30.—		**Badajo**
„ „	B	0.35	12 mm ($^1/_2$")	30.—		**Badajuelo**
„ „	C	0.40	7 mm ($^9/_{32}$")	36.—		**Badanado**
„ „	D	0.65	4.3 mm ($^1/_6$")	42.—		**Badanero**
„ „	DD	0.85	4.3 mm ($^1/_6$")	54.— **Badanilla**	74.—	**Badernon**
„ „	E	0.85	2.7 mm ($^1/_9$")	66.— **Badaza**	86.—	**Badlana**
„ „	F	0.85—0.90	1.85 mm ($^1/_{14}$")	84.— **Badilazo**	104.—	**Badilico**
Plankton-Searcher		0.11	33 mm ($1^3/_8$")	20.—		**Badomia**
Water-Immersion	D*	0.75	4.3 mm ($^1/_6$")	75.—		**Bafar**
	H	1.15—1.20	2.4 mm ($^1/_{10}$")	110.— **Bafo**	130.—	**Bafanero**
	J	1.15—1.20	1.8 mm ($^1/_{14}$")	144.— **Bafetas**	164.—	**Bagaje**
*Homog. Immersion	$\frac{1}{12}$	1.25	2.0 mm ($^1/_{12}$")	160.—		**Bagatela**

Cedar-wood oil, per bot. Mk. 0.75. **Bagazo.**

Cap-bottles for immersion oil or MACH's **Conical Bottle** (see Figs. 3[a] and 3[b], p. 6) for the convenient use of the immersion-oil, each Mk. 1.00 **(Baalita)** and Mk. 1.50 **(Babada)** respectively.

Table of Magnification

of the Achromatic Objectives with the Huyghenian Eye-pieces,

calculated for a tube-length of 160 mm and an image distance of 250 mm.

Eye-piece:	1	2	3	4	5	
a_1	7	10	15	20		a_1
a_2	11	16	23	30		a_2
a_3	20	30	40	50		a_3
a*	4—8	7—14	10—20	15—30		a*
aa Plankton-Searcher	25	35	50	60	80	aa Plankton-Searcher
A, AA	37	50	70	90	115	A, AA
B	60	85	115	145	185	B
C	105	145	200	265	325	C
D, DD, D*	175	240	325	420	540	D, DD, D*
E	280	390	535	680	865	E
F	415	585	790	1000	1275	F
H	320	440	610	770	985	H
J	430	585	810	1030	1315	J
$\frac{1}{12}$	385	530	730	925	1180	$\frac{1}{12}$
	1	2	3	4	5	

Table of the Free Working Distances and Diameters of the Area of Objects

embraced by Achromatic objectives in conjunction with the HUYGHENIAN Eye-piece 2

(with a tube length of 160 mm).

	Free Working Distance mm	Diameter of visible Area of Object mm
a_1	20	11
a_2	30	8
a_3	33	4.5
a*	13—53	10—25
Plankton-Searcher	36	4
aa	14	4
A	9	2
AA	7.5	2.5
B	3	1.5
C	2	0.9
D	0.6	0.5
DD	0.4	0.5
D*	1.5	0.55
E	0.25	0.35
F	0.17	0.23
H	0.2	0.32
I	0.2	0.23
$\frac{1}{12}$	0.15	0.25

With regard to the sense in which the expressions "free working distance" and "diameter of the area of the object" are here being used we refer to the remark appended to the table on p. 19. In the case of a_1 and a_2 the free working distance is reckoned from the lower edge of the mount.

Huyghenian Eye-pieces.

We supply these for use with the ordinary achromatic objectives. Their focal lengths and magnifications are shown in the following table.

Eye-piece No.	1	2	3	4	5
Focus in mm	50	40	30	25	20
Eye-piece magnification	3	4	5.5	7	9
Code-words	**Bagunl**	**Baharero**	**Bahlero**	**Bahuno**	**Balla**

Price Marks 7.— each.

The magnification of these eye-pieces is computed by the same rule as in the compensating series (see page 17), the varying position of their lower focal planes being taken into consideration.

We make a Huyghenian Eye-piece 2* with iris-diaphragm on the same lines as our Compensating Eye-piece 4* with iris. What has been said with regard to Compensating Eye-piece 4* applies equally to the Huyghenian Eye-piece 2*.

Price of the Huyghenian Eye-piece 2*: Marks 30.—. Code-word: **Ballador.**

With regard to the selection of eye-pieces for a microscope we would remark that all our achromatic objectives are capable of giving useful magnifications for regular observation even with Eye-piece 4, good illumination being understood when the highest powers are used.

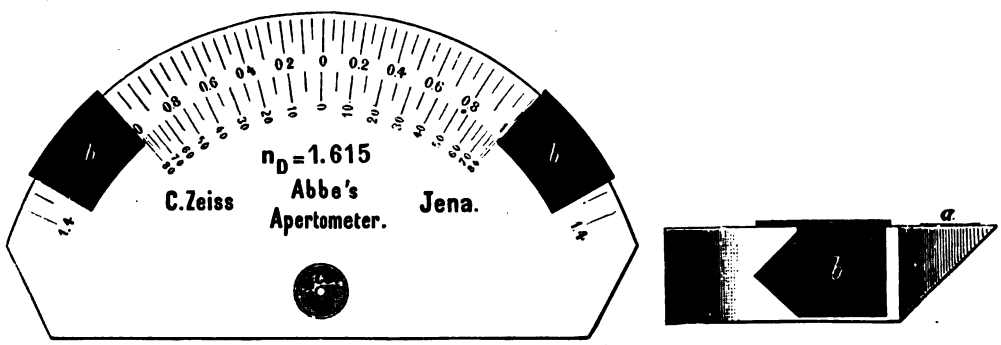
Respecting the use of Compensating Eye-pieces with Achromatic Objectives see p. 24.

We do not supply Huyghenian Eye-pieces for the long (English) tube.

Eye-pieces for special purposes (Micrometer, Spectroscopic and others) see No. 28—30 and 52—55.

Auxiliary apparatus for testing the fundamental properties of microscope objectives.

No.		*Prices in Marks. Code-words.*
1	***ABBE's Apertometer** (Fig. 13), for determining the numerical and angular aperture of objectives (Journ. of the R. Micr. Soc. 1878, p. 19 and 1880, p. 20; see also DIPPEL, Das Mikroskop, p. 348). It is adapted for any large stand fitted with a draw-tube. In case, including an auxiliary objective, with directions	**70.— Ballesa**



View from above. Side view.

Fig. 13.
Apertometer.

2	***The same instrument** with glass disc mounted on metal plate with a slot for the more certain and more accurate adjustment of the indices	**90.— Bailleo**

No.		*Prices in Marks. Code-words.*
3	***ABBE's Test-plate,** for testing lenses with respect to spherical and chromatic aberrations and for estimating the thickness of the cover-glass which corresponds to the most perfect correction. — Six cover-glasses having the exact thickness marked on each (0.09 to 0.24 mm), cemented side by side on a slip, their lower surface being silvered and engraved with parallel lines, the serrated edges of which form the test object. For use with the ABBE Condenser. With instructions. In case	**10.— Bairau.**

Stands.

The general form of our stands, like most others of continental design, originated in the type first introduced by OBERHÄUSER and subsequently developed by HARTNACK.

Latterly we have endeavoured to perfect the mechanical details of the microscope and have made several improvements in the three main points constituting the fundamental features of a stand, viz. the stage, the means of focussing and the illumination.

A. The stage.

The dimensions of the stage of all our stands except the Laboratory Stands VI[a] and VII are sufficiently large to allow of any size of slip or cultivation plate or dish being used.

The **stage** is provided with an **opening** of 33 mm ($1^5/_{16}$") in the case of stands I to IV, in order that the large field possessed by the objectives of long focus (including the projection-lens of 70 mm) may be fully utilized. It can, however, be reduced to the diameter of the upper lens of the condenser, by the insertion of a diaphragm provided for the purpose, in cases where very small slips are to be used.

The **height of the stage** of Stands II[a] to IV is reduced to the lowest limit which will admit of the adaptation of the ABBE illuminating apparatus, in order that the hands may rest on the table when manipulating on the stage. In the larger stands (I[a], photo-micrographic and large mineralogical stands) the stage is made higher to facilitate in special work the employment of other illuminating appliances beside the ABBE illuminator, such as Nos. 21, 22 and 23.

Mechanisms for moving the object are provided in Stands I[a], II[a], the Photo-micrographic and Mineralogical Stands.

These consist of the following arrangements:

a) Revolving stage-plate with arrangement for centring, as in Stands I[a] and II[a], and without centring arrangement, as in the Mineralogical Stand.

b) Mechanical stages for Stand I[a] and the Photo-micrographic Stand. The stage of Stand I[a] is adapted for moderately fine movements of the object, but possesses a considerable range. It may be substituted for the simple rotating stage-plate of the mineralogical stand. The micrometer-stage of the photo-micrographic stand is adapted for very delicate movements of the object.

The Attachable mechanical stage No. 64 is adapted for Stands II[a] and IV. For very fine lateral movements, especially those envolving measurements we recommend the Stage Screw-micrometer No. 31.

The mechanical movement of the object is advantageous or even necessary in the following cases:

1. In the employment of high power lenses, when it is required to bring a point seen at the margin into the middle of the field. The small amount of movement necessary to accomplish this may be effected, to a certain extent, by the centring arrangement of the revolving stages of Stands I[a] and II[a].

2. For systematically searching a preparation.

3. For counting particles within a specified area of the surface of the object.

4. For marking a certain part of a preparation with a view of refinding it.

5. For the projection of images on the screen, since it is inconvenient and difficult to manipulate a slide on the stage when the latter is in a vertical position.

B. The Focussing of the Objectives.

The coarse adjustment. The coarse adjustment of the sliding tube type has been discarded in all except Stand VII. All the other stands are fitted with rack and pinion adjustment. We have constructed special machines for the accurate production of the oblique tooth-gearing, and this motion is now made in such perfection that objectives of medium power can be focussed by it alone without the use of the micrometer-screw.

The fine adjustment. The micrometer movement introduced by us in 1886 (see Zeitschr. f. wiss. Mikroskopie, Vol. 2, p. 207, 1886) has during this long period been in extensive use and has proved absolutely satisfactory. We have therefore retained it in our microscopes. The superiority of this arrangement is mainly due to the fact that the force exercised by the micrometer-screw is transferred to the movable body by a single contact between two hardened steel surfaces. This ensures an extremely delicate and uniform motion of the body which carries the tube.

The divisions on the milled head of the micrometer-screw of Stands I^a—IV furnish a means for exactly registering the vertical movements of the tube. In our present stands each division corresponds to an elevation or depression of the tube in the direction of the optical axis of 0.01 mm, the half divisions representing 0.005 mm.

By this means **measurements of thickness** may be made with a considerable degree of accuracy. The upper and lower surfaces of the object are successively focussed and the amount read off on the milled-head by the fixed index. In doing this care must be taken to make both adjustments by a rotation of the screw in the same direction. The thickness of an object in air is then equal to the difference between the two readings.

Similarly, the thickness of any other substance may be measured by this method. **The estimation of the thickness of a cover-glass,** for instance, is best done as follows: With a medium power dry lens (D or E) and eye-piece 3 or 4, using central illumination, focus the upper and lower surfaces of cover-glasses of exactly known thickness — e. g. the covers of an ABBE test-plate — and note the apparent thickness so obtained. A comparison of this with the known true value gives, once for all, the coefficient for reducing to their true values measurements of any other covers, made with the same objective under precisely similar conditions. Roughly speaking this coefficient is equal to 3/2 or more exactly 1.52 (the refractive index of glass). The thickness of a section is estimated in a similar manner.

The draw-tube which is possessed by all stands with the exception of Stand IX and the Hand-microscope, admits of the tube-length being increased or diminished. With Stands I[a] to IV the length of the tube may be read off by means of a millimetre-scale engraved upon the tube. The lower end is provided with the standard screw to take the auxiliary objective used with the apertometer (see p. 29).

The internal diameter of our draw-tube is 23.3 mm at the eye-piece end.

C. The Illumination of the Object.

The modern microscope is essentially constructed for illumination with transmitted light. Ordinary microscopic observation requires exclusively illumination by diffuse white (day or lamp) light, but the incident pencil should be capable of wide variation as regards its angular aperture (wide or narrow illuminating cone) and its direction (central or oblique light). These requirements are fulfilled by the **ABBE Illuminating Apparatus,** first introduced by us in 1873 (MAX SCHULTZE'S Archiv f. mikr. Anatomie, Vol. IX, p. 413, 1873), which is now so generally employed and so universally acknowledged as an indispensable accessory in advanced microscopic work that it forms an essential adjunct to all stands intended for scientific research. For description see No. 17.

In all our illuminating substages, Nos. 17 to 20, the condenser is mounted in a cell which slides into a sleeve forming part of the substage. This arrangement provides in the simplest possible manner for the interchange of various forms of condensers, diaphragms and special illuminators, such as will be found described under Nos. 20 to 23.

Any of these substitutions may be made at the time when the stand is purchased.

Our **Swing-out Condenser with Iris-Cylinder Diaphragm,** introduced in 1894, renders the interchange of the condenser and ordinary diaphragm extremely simple. Details of this form of condenser will be found under the heading of Illuminating Apparatus (No. 102).

All the large and medium size stands are supplied in solid mahogany cabinets (Fig. 14).

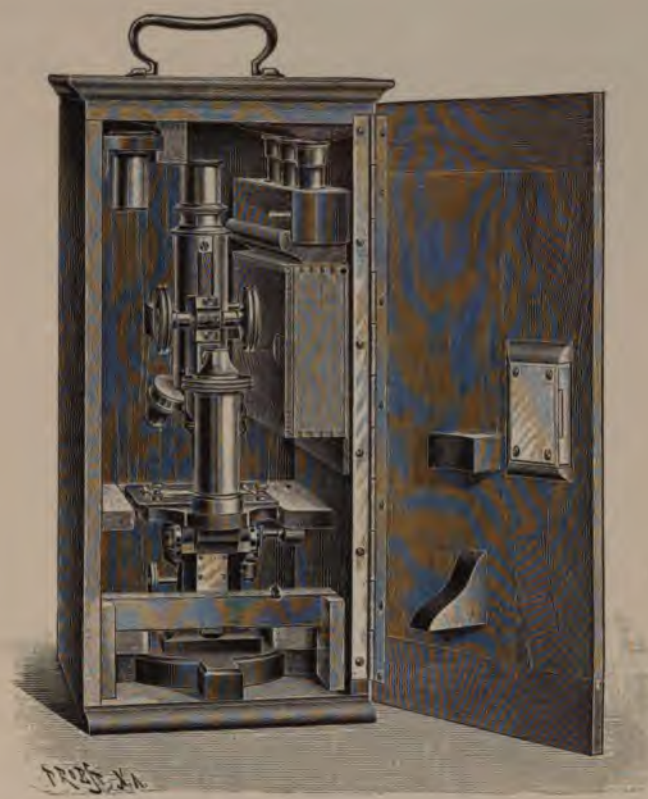


Fig. 14. Stand IVa placed in its case.

Their size is reduced as much as possible for the sake of compactness, yet sufficient room is provided for the entire instrument in working order, with its objectives, nose-piece and eye-piece, and for an ample assortment of objectives, eye-pieces and the usual accessory appliances.

Stands VII and IX are supplied in flat mahogany cases, in which the stands are placed horizontally.

The price of the case is always included in that of the stand.

The cases are, if desired, furnished with the following accessories:

Nickelled name plate, including engraving, to screw on the door, Mk. 5.—. **Baivel.**

The cost of engraving the name on the stand itself is Mk. 3.—. **Bajada.**

Leather travelling-cases, according to size Mk. 18.— to 30.—.

Fig. 15.
Leather Case for Microscope Cabinets.

A. Large Stands.

Prices in Marks.
Code-words.

Stativ I^a (Fig. 16). A large instrument suitable for the majority of special requirements and adapted for all our accessory apparatus. The upper body is inclinable from the vertical to the horizontal position.

Coarse adjustment by rack and pinion, fine adjustment by micrometer-screw with divided head (see p. 33).

ABBE illuminating apparatus vertically adjustable as a whole by rack and pinion movement (see Fig. 18). Condenser of 1.40 num. apert. which, by means of a small lever projecting from under the left side of the stage (not shown in fig. 16), may be **swung out** of its central position so as to facilitate rapid transition to illumination with the cylinder-diaphragm. The latter is made in the form of a **cylinder fitted with an iris-diaphragm;** it is fixed to the condenser and the iris closes and opens by means of a small milled-head projecting from the iris-collar (see below No. 102). Below the condenser is the movable iris-diaphragm fitted with a rack and pinion movement to throw it out of the centre and which can be rotated about the axis or entirely swung out.

Prices in Marks.
Code-words.

The circular object-stage has a diameter of 120 mm = $4^3/_4$ in. and rotates about the optic axis, and it may be centred with respect to the latter by two milled-head screws and a counter-pressure pin.

The stand is supplied either **with solid plain vulcanite stage,** at . . . . . **325.— Bajadura**
or instead of the latter with our new **large mechanical stage** (see Zeitschr. f. wiss. Mikrosk. Vol. 11, p. 18), at . . . . . **400.— Bajalato**

The available lateral movement measures 50 mm = 2 in. and the stage moves through 35 mm = $1^1/_2$ in. in the direction from front to back. The amount of the movement is read by verniers and scales.

Our new mechanical stage is so **solidly** constructed that possessors of a stand fitted with it may well dispense with the plain vulcanite stage. The mechanism (*L K*) which serves for the lateral movement of the object **lifts off** after unscrewing the fixing screw *L*, whereby the solid lower part of the stage becomes free. By means of the milled head *W* this lower part of the stage can be made to move in a forward and backward or — if the whole stage be rotated — in any other desired direction.

The mechanical stage is readily replaced by the plain stage by turning the centring-screws back and pressing the stage while still attached to the stand forward against the buffer-pin, when it easily lifts out of its seat. The other stage is attached in a precisely similar manner.

An object-slide having a cross ruled upon it is supplied with the stand to facilitate the process of centring. (For particulars see the directions for using this adjunct.)

If desired, we supply also the lower body and stage of Stand I[a] fitted with the upper body and tube of the Photographic Stand, and conversely, without changes in the prices.

The Mechanical Stage belonging to Stand I[a] may be had separately and is made to gauge, so as to be readily adaptable to any of our Stands I[a] provided with centring rotating stages. Price . . . **100.— Bajamano**
Price of the **Vulcanite Stage** separately . . . . . **25.— Bajamiento**

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars. Note the remark on p. 34 respecting the selection or addition of other illuminating appliances.

Suitable complete specifications are compiled at the end of this catalogue.

Fig. 16.
Stand Ia with large mechanical stage.
(1/2 Full Size.)

Prices in Marks.
Code-Words.

Photo-micrographic Stand (Fig. 17). This stand is in point of size and general arrangement similar to Stand I^a.

The round rotating stage is of solid brass and has a diameter of 100 mm = 4 in. It may be moved in two directions at right angles to one another by means of the conaxial milled-heads *H* and *V* (Fig. 17). The position of the stage reads off by verniers.

The mechanical stage of the above stand is constructed with a view to impart a very slow motion to the object so as to render it particularly suitable for the projection of a magnified image on a distant screen. Its solid construction admits, as in the case of Stand I^a, of the use of any kind of object-carrier, in particular, also of culture-plates and dishes.

The body-tube is very short and unusually wide so as to provide for the application of our Projection-lens of 70 mm focus (see Fig. 6 p. 12).

This stand may, with advantage, be used for usual ocular observation.

With ABBE illuminating apparatus No. 17 fitted with ordinary (non-achromatic) condenser of 1.40 apert. and iris-diaphragm . . . . **375.— Bajedad**

For the purposes of photo-micrography or projection on the screen it is advisable to substitute for the usual condenser of 1.40 aperture the achromatic centring condenser of 1.0 aperture No. 20, price **Mk. 75.—**. This condenser may, naturally, be used for ocular observation as well, in all cases where its aperture is sufficiently large.

A Cylinder-diaphragm fitted with iris slipping into the sleeve in place of the condenser system may be supplied with the stand or may subsequently be added, at a cost of Marks **14.—**.

The same Stand with Iris-cylinder diaphragm and swing-out condenser of 1.40 aperture (in lieu of the usual condenser) . . . **400.— Bajelero**

If desired, we supply also the upper body and tube of the Photographic Stand fitted to the lower body and stage of Stand I^a, and conversely, without changes in the prices.

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars. Note the remark on p. 34 respecting the selection or addition of other illuminating appliances.
Suitable complete specifications are compiled at the end of this catalogue.

Fig. 17.
Photo-micrographic Stand.
($^1/_2$ Full. Size.)

Carl Zeiss, Optische Werkstaette, Jena.

Prices in Marks.
Code-words.

Large Mineralogical Stand (Fig. 18). This stand is similar to Stand I[a] in form and size. It has an inclinable body, coarse adjustment by rack and pinion, fine adjustment by means of micrometer-screw with divided head.

ABBE illuminating apparatus, adjustable by rack and pinion *W* fitted with iris-cylinder diaphragm and swing-out condenser of 1.40 aperture for rapid transition from parallel to convergent light, see No. 102, p. 58. Respecting the adaptation of any of the illuminating appliances Nos. 20 to 23 see the remark on p. 34. Diaphragm-carrier with iris-diaphragm adapted for the insertion of central-stop diaphragms, mica and selenite films and Nicol polarizer *P*. This diaphragm-carrier admits of rotation about the optic axis, of being placed obliquely and of being entirely swung out of the axis, as shown in Fig. 18.

Rotating and permanently centred stage with divided circle at the circumference and cross-lines at right angles to one another. For this stage our new large mechanical stage as described on p. 38, but similarly divided, may be substituted.

The draw-tube is provided with a mm-scale. It is separately adjustable by means of rack and pinion *g* and carries at its lower extremity an AMICI (BERTRAND) lens *B*, which is inserted through an opening in the outer tube; at the upper end, which takes the oculars, stauroscopic plates and the analyzer *A*, it is provided with a divided circle *T*. The tube is provided at its lower end with BIOT-KLEIN'S quartz plate *K*, above which an analyzer (not shown in the figure) slides in and out in a light-tight fitting, and a centring adapter *cc* for the objectives.

With condenser of 1.40 aperture, Iris-diaphragm, Polarizer, one Analyzer above the ocular, another above the objective, KLEIN'S quartz plate and AMICI lens . . . . . **575.— Bajete**

The same with large mechanical stage in place of the fixed rotating stage . . . . . **650.— Bajillo**

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars. Note the remark on p. 34 respecting the selection or addition of other illuminating appliances.
Suitable complete specifications are compiled at the end of this catalogue.

Fig. 18.
Mineralogical Stand.
($^1/_2$ Full Size.)

	Prices in Marks. *Codc-words.*	
We supply also the following accessories and auxiliary apparatus for mineralogical and crystallographic research:		
Huyghenian eye-pieces 1 to 5 with crossed lines . . . . each	10.—	
Bertrand eye-piece (with quadruple quartz-plate)	35.—	**Bajista**
Stauroscopic plate, for placing on ocular	7.—	**Bajoca**
1 **Mica film** of $^1/_4$ λ for determining the nature of double refraction in **convergent** light	2.—	**Bajotraer**
1 **Selenite film,** Red of the 1st order for determining the nature of double refraction in **parallel** light, each being interchangeable for KLEIN's quartz-plate	3.—	**Bajorelieve**
Our two smaller mineralogical stands are described in a separate price-list, which may be had on application.		

B. Stands of Medium Size.

Stand II^a (Fig. 19). This stand has a stage fitted with a revolving vulcanite disc of 100 mm = 4 in. dia, which may be centred by two screws with milled-heads acting against a buffer-pin fitted into the stage, thus serving to a certain extent as a slow movement stage.

Coarse and fine adjustments as in the preceding stands.

ABBE illuminating apparatus No. 17 with iris-diaphragm and condenser system of **1.40** num. apert. in sliding sleeve, interchangeable for the achromatic condenser and other illuminators. The latter can, however, only be used when the stand is in its inclined position owing so its low stage.

In mahogany cabinet	290.—	**Bajoncillo**
The same stand with swing-out condenser of 1.40 aperture and stationary iris-cylinder diaphragm in lieu of the ordinary condenser	315.—	**Bajonero**

The Iris-cylinder diaphragm slipping into the sleeve in place of the condenser system may be supplied with the stand, or subsequently, at a cost of **Mk. 14.—**, the ordinary cylinder-diaphragm at a cost of **Mk. 4.—**.

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars. Note the remark on p. 34 respecting the selection or addition of other illuminating appliances.

Suitable complete specifications are compiled at the end of this catalogue.

Fig. 19.
Stand IIa.
(1/2 Full Size.)

Prices in Marks.
Code-words.

Stand IV^a (Fig. 20). Inclinable. Fixed vulcanite stage 90×90 mm square ($3^1/_2 \times 3^1/_2$"), otherwise similar to the preceding instrument.

ABBE illuminating apparatus No. 17 with iris and condenser of **1.20** num. apert.

In mahogany cabinet . . . . . **250.— Bajuelo**

The same stand with swing-out condenser of 1.20 aperture and **stationary iris-cylinder diaphragm** . . . . . **275.— Bajura**

A simple cylinder-diaphragm to replace the condenser, at **Mk. 4.—**, or an iris-cylinder diaphragm, at **Mk. 14.—**, may be supplied with the stand or added at any subsequent time.

Stand IV^b. Similar to IV^a, but **without ABBE illuminating apparatus.** This is replaced by the ordinary plane and concave mirror with universal motions and the ordinary cylinder diaphragm which is fixed to the under surface of the stage by a bayonet joint. This arrangement permits of a rapid interchange of the diaphragm for the simplified ABBE illuminator No. 18 (condenser system of 1.20 num. apert. with centrally fixed iris-diaphragm). This is the smallest of our stands which is adapted for advanced work. The use of special illuminators is subject to the same restrictions as in the case of Stands II^a and IV^a owing to its low form.

With cylinder-diaphragm in mahogany cabinet . . . . . **175.— Bala**

The same with iris-cylinder diaphragm instead of the ordinary diaphragm . . . . . **185.— Baladronada**

The same with Illuminating Apparatus No. 18 instead of the cylinder-diaphragm . . . . . **200.— Balacea**

The same with swing-out condenser No. 102^e and iris-cylinder diaphragm . . . . . **230.— Baladrar**

The achromatic condenser cannot be used with Stand IV^b.

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars. Note the remark on p. 34 respecting the selection or addition of other illuminating appliances.

Suitable complete specifications are compiled at the end of this catalogue.

Fig. 20.
Stand IV[a].
(1/2 Full Size.)

Small Stands.

(In the event of a considerable number of these smaller stands being ordered at one time they can be supplied together in a plain packing case at correspondingly reduced prices.)

Prices in Marks.
Code-words.

Stand VI[a] (Fig. 21). Fixed stage 80 × 80 mm (3¼ × 3¼ in.). Rack and pinion coarse and micrometer fine adjustment. The tube when fully extended is 160 mm (6¼ in.) long. (The correct position of the tube when a revolving nose-piece is being used is shown by a mark cut on the draw tube.)

This stand is inclinable.

Illumination by means of a combined plane and concave mirror which is movable in all directions. Cylinder-diaphragm in sliding sleeve fixed below the stage by a bayonet joint. When extremely oblique illumination is required the two set-screws by which the sleeve is fixed may be unscrewed and the sleeve removed. The cylinder diaphragm may be readily removed and replaced by an Iris-cylinder diaphragm or the illuminator No. 19 (of num. apert. 1.0).

With ordinary **cylinder-diaphragm**	**130.—**	**Balador**
„ **Iris-cylinder diaphragm** in place of the ordinary cylinder-diaphragm	**136.—**	**Balagar**
„ **Illuminator No. 19** (fitted with iris-diaphragm) in lieu of the ordinary cylinder-diaphragm	**150.—**	**Balahu**

Owing to its compactness Stand VI[a] is particularly adapted as a **Small Laboratory** and **Travelling Microscope** (see JOHNE, Deutsche Zeitschrift f. Thiermedicin u. vergl. Pathologie, Vol. 20, pp. 418—425, 1894). It admits of the use of even the highest powers but it is not adapted for work with large culture plates, photo-micrography and special investigations necessitating the employment of any of the appliances Nos. 17, 18, and 20 to 23.

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars.

Suitable complete specifications are compiled at the end of this catalogue.

Fig. 21.
Stand VIa. (1/2 Full Size.)

Prices in Marks.
Code-words.

Stand VII (Fig. 22). This stand is not inclinable. It is provided with a sliding-tube for the coarse adjustment and a micrometer fine adjustment. The stage is fixed and measures 63 × 70 mm = $2^1/_2 \times 2^3/_4$ inches. The stand is substantially built for laboratory use. The illuminator No. 19 can be used with it as with Stand VI[a]. In mahogany case.

With ordinary **cylinder-diaphragm** . . . . . 80.— **Balandra**

„ **Iris-cylinder diaphragm** in place of the ordinary cylinder-diaphragm . . . . . 86.— **Balanitis**

„ **Illuminating system No. 19** (with iris) in the place of the ordinary cylinder-diaphragm . . . . . 100.— **Balanzario**

The great care taken in the construction of the micrometer adjustment of Stand VII renders it available for use with the highest dry powers. These stands are hardly adapted for the use of immersion lenses, and extreme care is needed if they are put to such an exceptional purpose.

Stand VII cannot subsequently be fitted with a rack and pinion adjustment.

When using a revolving nose-piece with these smaller stands a **Clamping-ring** (Each Marks 3.— **Balar**) will be found desirable. This prevents the tube from sliding down in consequence of the weight of the nose-piece and 2 or 3 objectives attached to it.

A revolving nose-piece cannot be used on Stand VII in conjunction with Objectives a_1, a_2, a_3, a* and aa, owing to the insufficient distance between the stage and the tube. For the same reason the sliding-tube objective-changers cannot be used on Stand VII with any of our objectives.

Objective a* cannot be used on Stand VII without, at low magnifications, sacrificing a portion of the field, owing to the limited size of the stage-opening.

For **Dissecting Stands** see pag. 93 to 103.

The prices of the Stands include only the case and the fittings specified in the above description, without revolving nose-piece, objectives and oculars.
Suitable complete specifications are compiled at the end of this catalogue.

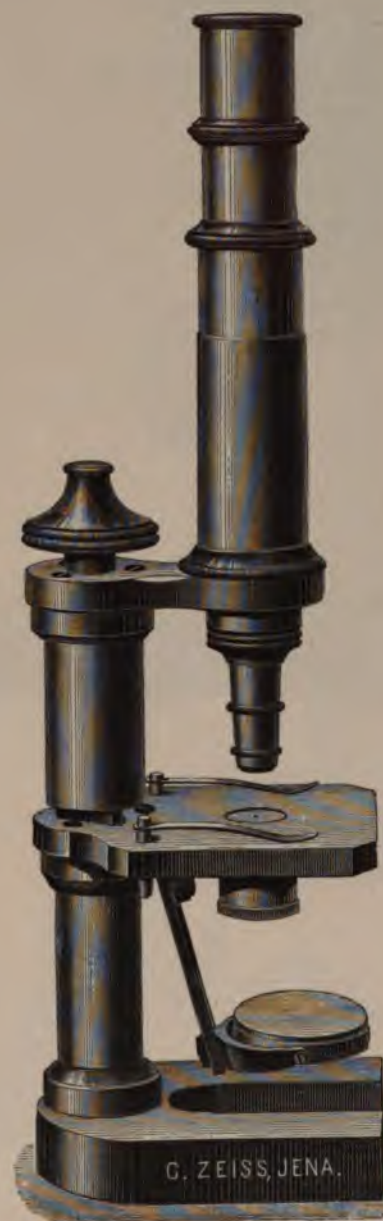


Fig. 22.

Stand VII. ($^1/_2$ Full Size.)

Prices in Marks.
Code-words.

Stand IX (Fig. 24). Simple auxiliary stand for laboratory and technical purposes.

Plain large stage of 100 mm (4") dia. with large stage-opening which may be diminished by a diaphragm.

Large plane and concave mirrors.

Adjustment by rack and pinion, the construction of which admits of the convenient use of medium powers (C, D). In mahogany case . **50.— Balasor**

Together with a specially constructed triple objective and 2 eye-pieces giving 6 magnifications of 30 to 190 diameters, recommended by Prof. JOHNE, of the Veterinary College of Dresden, for the detection of **trichina** . . . . . **80.— Balaustra**

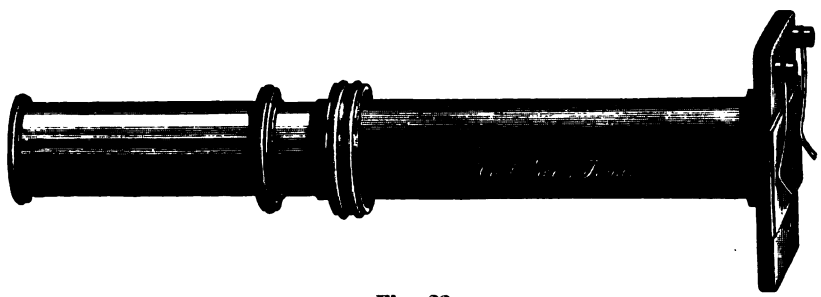


Fig. 23.
Hand Microscope. (1/2 Full Size.)

Hand Microscope (Fig. 23), for class demonstration. Stage with clips to hold the specimen; sliding tube, which after adjustment is securely fixed by a clamping ring. Fine adjustment is effected by altering the position of the eye-piece. In using it is directed by hand towards a window or lamp. Available even with objective D. Without objective, or eye-piece, in a plain case . . . . . **15.— Balconada**

The prices of the Stands include only the case and the fittings specified in the above description.

Suitable complete specifications are compiled at the end of this catalogue.

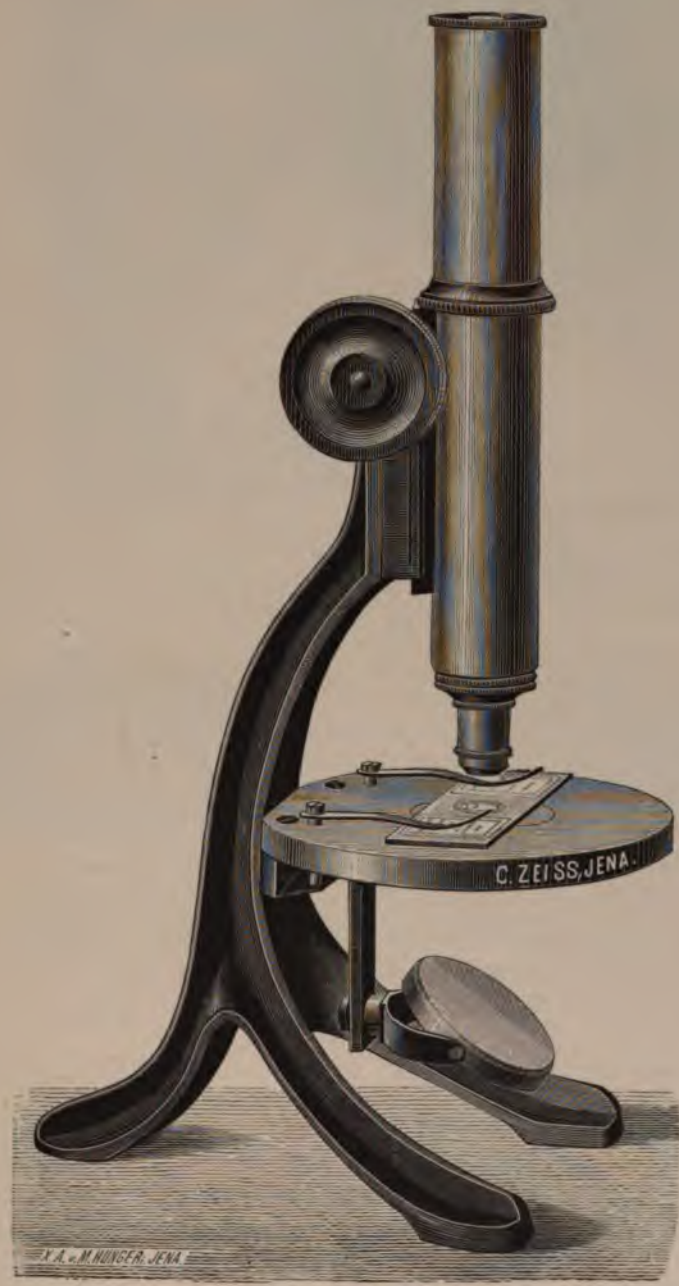


Fig. 24.

Stand IX. (1/2 Full Size.)

Illuminating Apparatus.

A. For white light.

No.		*Prices in Marks. Code-words.*
17	***ABBE's Illuminating Apparatus** (Fig. 25, pag. 55). The essential feature of this apparatus is a condenser system of short focus, which collects the light reflected by the mirror so as to form a cone of rays of very large aperture having its focus in the plane of the object. The full aperture of the illuminating cone should only be used when finely granular and deeply stained particles (plasm, bacteria etc.) are being examined with objectives of large aperture. In all other cases the cone must be suitably reduced either by an iris (see below) or common diaphragm *(central illumination)*. By placing the diaphragm excentrically, by means of the rack work attached to the carrier, the central rays are cut off and a certain extra-axial portion of the illuminating pencil falls upon the object *(oblique illumination)*. — When the diaphragm is thus excentrically placed the oblique pencil can be directed from all sides by rotating the carrier round the optic axis. The central-stop diaphragm shuts off all the axial and transmits only the marginal rays, thus producing *dark-ground illumination* (see Special Instructions). The **Condenser** is made in two forms, viz. as a) a double combination of 1.20 num. apert., and b) a triple combination of 1.40 num. apert. It is mounted in a sleeve which fits a spring jacket on the apparatus. This arrangement facilitates the interchange of the two	

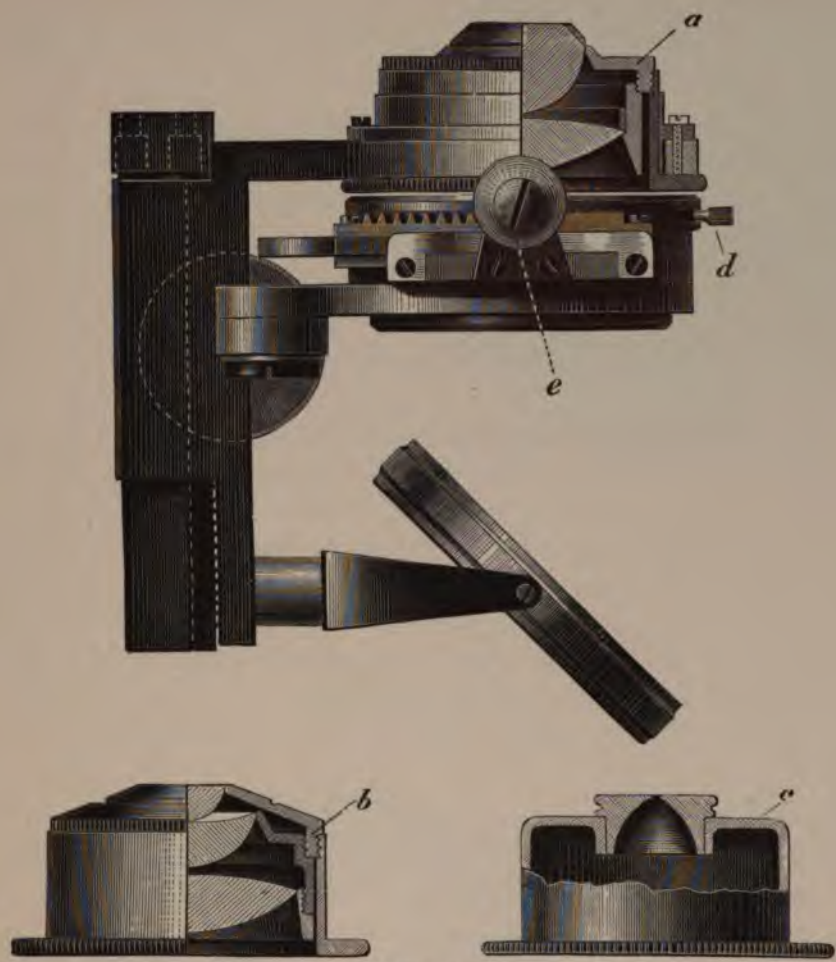


Fig. 25.

Abbe Illuminating Apparatus.

a) Condenser of 1.20 num. apert., *b)* condenser of 1.40 num. apert., *c)* cylinder-diaphragm, *d)* pin for contracting or dilating the iris-diaphragm, *e)* milled-head for throwing the diaphragms out of centre.

No.		*Prices in Marks. Code-words.*
	condensers and also serves to carry the following appliances in their places: 1) the ordinary cylinder-diaphragm or the iris-cylinder diaphragm (see below No. 103), 2) the swing-out condenser No. 102, 3) the Special Illuminating Appliances described under Nos. 20—23.	

No. | *Prices in Marks Code-words.*

Most of these appliances require adjustment with respect to the plane of the object. The frame-work of the ABBE illuminator is therefore fitted with rack and pinion for adjustment in the direction of the optic axis. Any microscope with this fitting is adapted for use in conjunction with any other form of illuminator which may be required, excepting the largest illuminators, which can only be used on our large stands.

The **Iris-Diaphragm,** which is now invariably included in the ABBE illuminator, is a very convenient substitute for the ordinary interchangeable diaphragms, as it affords a ready means of gradually increasing or diminishing the aperture with the greatest precision. Its smallest aperture is about 0.5 mm, its widest opening is equal to the full aperture of the condenser system, so that it may remain in its place when either the central-stop diaphragm or polarizer is in use, or when, according to Koch's method, the condenser is used at full aperture.

We do not supply the large ABBE illuminating apparatus separately, as, generally, considerable trouble and annoyance is caused by the attempt to fit it to stands of a different make, this being in many cases an utter impossibility.

The following separate parts of the Illuminating Apparatus No. 17 may be supplied singly:

a) The **Double Condenser** of 1.20 aperture . . . . . **20.— Baldear**
b) The **Triple** „ of 1.40 aperture . . . . . **25.— Baldosa**

These prices **include the sliding sleeve.**

c) The **Cylinder-Diaphragm,** which is a sliding sleeve fitted with 3 stops of different apertures (viz. 0.5 to 6 mm dia.) . . . **4.— Baldrero**
d) The **Iris-Diaphragm** . . . . . **10.— Balestero**

Dark-ground illumination. As a thoroughly good dark-ground illumination can only be obtained when the diameter of the central-stop of the diaphragm bears a certain definite relation to the numerical aperture of the objective we shall no longer supply these stops with the ABBE illuminating apparatus but they

No. | *Prices in Marks. Code-words.*

will be sent to order only together with any necessary objective-stops at the subjoined prices. When ordering stops for dark-ground illumination the objectives which are to be used should be specified since their apertures govern the size of the central-stops and objective-stops (see the Directions for using the Illuminating Apparatus).

Central-stop diaphragm with button for the central-stops .	0.50	**Balido**
Central-stops, each	1.—	**Balijero**
Objective-stops to screw into the mounts, each	0.60	**Balisa**
Do. for placing into the lens-mount, each . . .	1.50	**Balistica**

102 ***Swing-out Condenser** (Figs. 26 and 27). This condenser slips into the sliding sleeve of the illuminating apparatus No. 17 in precisely the same manner as the ordinary condenser and readily fits any of our large or medium size stands.

Fig. 26.
Swing-out Condenser.

The condenser system is by a suitable mechanism so connected to the sleeve enveloping it that, after swinging the diaphragm carrier *D* aside (towards the right of the observer), it may by means of the small lever *H* projecting from under the stage be swung downwards about the axis *Q* and then to the left about the pivot *Z*. When the condenser is not being used

No. | *Prices in Marks. Code-words.*

the width of the illuminating cone is regulated by means of the **Iris-Cylinder Diaphragm** which is permanently attached to the apparatus and is actuated by the small pin *K* seen on the right. The iris-diaphragm is so shaped that the edge of its smallest opening closely approaches the object slide. Further details will be found in the "Zeitschrift f. wiss. Mikroskopie", Vol. 11, p. 433, 1894, reprints of which may be had on application.

Care should be taken not to close the iris-cylinder diaphragm while the condenser is in its working position, as this attempt might injure the former.

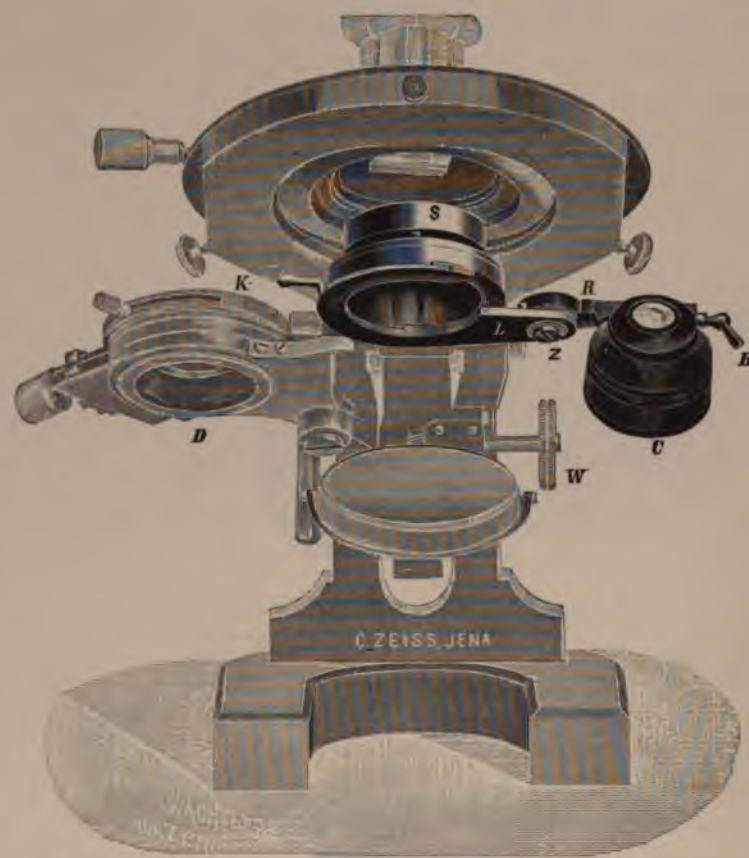


Fig. 27. Swing-out Condenser attached to Microscope.

The condenser is shown swung out and for the sake of clearness the whole illuminating apparatus is shown racked downwards (though for the purpose of adapting the mechanism this is not necessary, as pointed out in the description).

No.		*Prices in Marks. Code-words.*
	We supply the swing-out condenser fitted	
	a) **with Condenser No. 17a** (1.20 mm apert.) at . . .	**45.— Balitado**
	b) **with Condenser No. 17b** (1.40 mm apert.) at . . .	**50.— Balnadu**
	c) **with Condenser No. 17a** (1.20 mm apert.) and **centrally affixed Iris-diaphragm** (as a substitute for the Illuminating apparatus No. 18) for Stand IVb . . .	**55.— Baloncita**
103	**Iris-cylinder diaphragm.** In order to obtain a continuous graduation of the illumination when working without the condenser or with stands which are not provided with the swing-out condenser No. 102, we have recently devised suitable iris-cylinder diaphragms for all our stands. The laminae forming the apertures of these diaphragms are arched so as to make their edges touch the object-slide when the iris is entirely closed.	
	This iris-diaphragm may also be supplied for older stands, and fits, without special adaptation, into the sleeve provided for the condenser or the ordinary cylinder-diaphragm.	
	We supply:	
	a) **Iris-cylinder diaphragm for the large and medium size stands.** Price	**14.— Balsadera**
	b) **Iris-cylinder diaphragm for the small stands** (Fig. 28). Price	**8.— Balsamia**

Side-elevation and sectional view.

Plan-view.

Fig. 28.

Iris-cylinder diaphragm No. 103b.

(Full Size.)

No.		*Prices in Marks. Code-words.*
18	***Simplified Illuminating Apparatus** for Stands IV^b, being a Condenser of 1.20 num. aperture with iris-diaphragm (not adjustable excentrically), giving adjustable central illumination of any degree but not oblique light. It fits the sleeve fixed below the stage of Stands IV^b, having simply to be substituted for the cylinder-diaphragm	**30.— Balsar**
19	***Illuminating Apparatus** for Stands VI^a and VII (Fig. 29). Condenser of 1.0 mm aperture fitted with small iris-dia-	

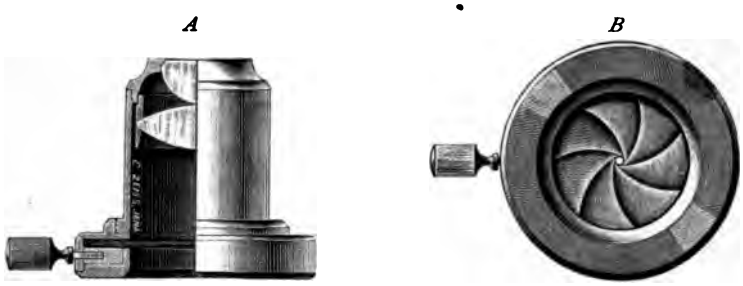


Fig. 29.
Illuminating Apparatus No. 19.

A. Side and sectional elevation. *B.* Plan-view of the iris-diaphragm. (Full Size.)

	phragm; to slip in place of the ordinary cylinder-diaphragm supplied with these stands	**22.— Balsilla**

We supply this illuminator fitted with iris-diaphragm only, the latter being indispensable.

Numbers 18 and 19 may be ordered at any time by possessors of the corresponding stands, as they are made to fit these without any alteration. For fitting an iris-diaphragm ordered subsequently to a condenser No. 19 it is necessary to have the latter sent to us. The price of the iris-diaphragm, including adaptation is Marks 8.—.

No. | *Prices in Marks. Code-words.*

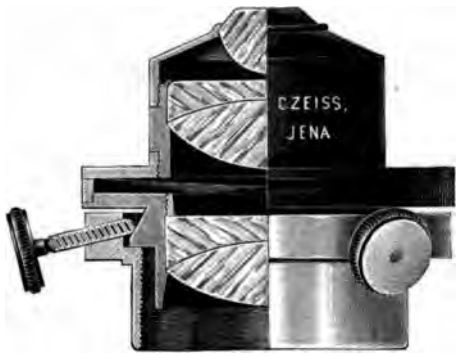


Fig. 30.
Centring Achromatic Condenser.
(Full Size.)

20 ***Centring Achromatic Condenser** (Fig. 30). Specially adapted for the requirements of photo-micrography, so as to project a sharp image of the source of light into the plane of the object. Achromatic condenser of N.A. 1.0 fitted with iris-diaphragm and centring arrangement. This condenser slips from above into the sleeve of the illuminating apparatus in the place of the ordinary condenser (No. 17 a or b). The condenser is focussed by means of the rack and pinion movement of the illuminating apparatus . . . . . **75.— Baltico**

The achromatic condenser cannot be used on Stands II^a and IV^a excepting in their inclined position. It cannot be fitted to Stand IV^b.

20* **Centring Achromatic Condenser of Aperture 1.30.** This condenser **is made to order only.** It is principally adapted for the examination of diatoms or similar preparations where it is desired that the condenser should be free from the aberrations possessed by the ordinary non-achromatic condenser and, at the same time, capable of yielding an **exceptionally large** or **very oblique** illuminating cone. Apart from this particular purpose it scarcely ever happens that any appreciable advantage is derived from this increase of aperture of the achromatic condenser. We give a decided preference to our other condensers, viz. the achromatic condenser of 1.0 num. apert. and the non-

No. | *Prices in Marks. Code-words.*

achromatic condensers, on account of their greater working distance and the broader image of the source of light which they project. The wide aperture achromatic condenser can be used with slides up to a thickness of 0.6 to 0.7 mm . . . . . **100.— Baltrieeto**

104 ***Vertical Illuminator** (Fig. 31). This serves to illuminate opaque objects from above and is made in the form of an adapter inserted between the tube and the objective. The light enters through a lateral opening in the revolving sleeve *R* and passes through the reflecting prism *P*, which covers half of the aperture of the objective. The rays are totally reflected by the prism and concentrated upon the object by the corresponding half of the objective. The diffuse rays reflected by the object are united by the other half of the objective and made to form an image of the object, which is observed in the usual manner.

Fig. 31.
Vertical Illuminator.
A. View of same partly sectional showing the lower tube and the objective; *B.* Plan-view.
($^2/_3$ Full Size.)

To obtain the proper incidence of the rays the fitting carrying the prism (together with the objective) is made to rotate about the optic axis. The reflecting prism *P* may within certain limits be inclined about an axis parallel to its edges by means of the milled-head *K*. The approximate position of the prism with respect to the source of light should, of course, be obtained by proper inclination of the stand or by adjusting the height of the lamp.

In case . . . . . **18.— Baluarte**

For observing uncovered objects (polished metallic sections etc.) with high powers the latter should be specially corrected (see p. 5).

B. Illuminating Apparatus for spectroscopically decomposed light.

No.		*Prices in Marks. Code-words.*
	The instruments Nos. 21, 22, 23 are used when it is required to illuminate a portion of an object in the field of the microscope with a single pure spectral colour or to observe the effect of the whole spectrum upon it, or to study the effects of the spectrum of polarized light. These instruments are connected to the ABBE illuminator by a centring-collar supplied with each instrument, and they are adjusted to the plane of the object by the rack and pinion motion of the illuminator. Owing to the insufficient height of their stages our medium sized Stands II^a and IV^a must be placed in the inclined position when any of these instruments are used.	
21	**HARTNACK's Illuminating Apparatus for monochromatic light.** The spectrum which this illuminator projects into the plane of the object is sufficiently extended to ensure approximately uniform monochromatic illumination with higher powers	120.— **Baluma**
22	***ENGELMANN's Micro-spectral Objective** for observing and measuring the effect of the colours of the spectrum on microscopical objects (Botanische Zeitung, 1882, No. 26; PFLÜGER's Archiv, Bd. XXVII, p. 464, Bd. XXIX, p. 415)	160.— **Balumbo**
23	***ROLLETT's Spectro-Polariser** (Zeitschrift für Instrumentenkunde, Vol. I, p. 366, 1881) as modified by DIPPEL (Das Mikroskop, p. 619). For determining the character of double refraction in microscopical objects with respect to light of particular wavelengths. Including two selenite films for red of the II. and III. order	200.— **Balza**
	We shall be pleased to send applicants detailed particulars in German on the construction and manipulation of the instruments Nos. 22 and 23.	

Appliances for Changing the Objectives on the Stand.

No. | *Prices in Marks Code-words.*

The appliances described in the following pages are not only designed for the rapid interchange of objectives but are so carefully made as to interfere as little as possible with the focussing and centring of the objective when the latter is changed. In a perfect changer the objective should remain very nearly in focus, requiring only a slight touch of the micrometer-screw to obtain perfect focussing, and the same part of the object should appear in the centre of the field. These requirements are only partially realized by the revolving nose-pieces, whereas the sliding objective changers admit of extremely accurate adjustment in both respects.

Respecting the elongation of the tube produced by the adaptation of these appliances see what has been said on pp. 3 and 4.

24 **Revolving Nose-pieces.** These are screwed into the microscope, a lock-screw collar with milled edge serving to fix the nose-piece in the desired position. As a rule, it is fixed so as to have the objectives which are not in a line with the tube turned symmetrically towards the front. The objectives are screwed into the 2, 3 or 4 screw holes of the nose-piece,

No.		*Prices in Marks. Code-words.*
	and can in succession be placed in a line with the tube. Their proper central position is maintained by a spring-catch. The objectives which are not in use are protected from dust and dirt by means of special guards. Both the guards and objective-rings upon which they fit are shaped to the same spherical curve by a method of our own and are perfectly dust-tight.	
	We supply the following three forms:	
	a) **Revolving Nose-piece for 2 objectives** (Fig. 32) . . .	**20.— Ballada**
	b) **Revolving Nose-piece for 3 objectives** (Fig. 33, see also Figs. 16, 19, 20)	**27.— Ballena**
	c) **Revolving Nose-piece for 4 objectives** (Fig. 34) . . .	**32.— Ballenero**

Fig. 32.
Revolving Nose-piece No. 24a, for 2 objectives.

Fig. 33.
Revolving Nose-piece No. 24b, for 3 objectives.

Fig. 34.
Revolving Nose-piece No. 24c, for 4 objectives.
(All Full Size.)

In the case of Stand VII, which is not fitted with rack and pinion coarse adjustment, it is advisable to use, in conjunction with the revolving nose-piece, a ***Clamping-ring*** *(**Marks 3.**— **Balleston**), by means of which the tube may be fixed in any suitable position.*

Fig. 35.

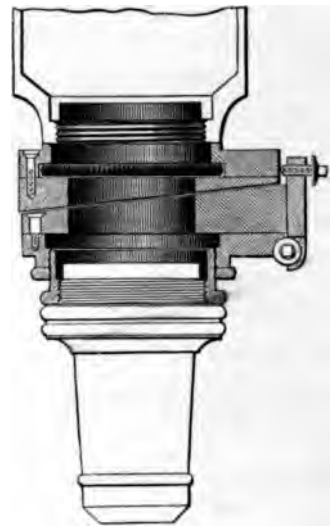


Fig. 36.

Sliding Objective-changer.
(Full Size.)

No. | *Prices in Marks Code-words.*

25 ***Sliding Objective-changer** (Figs. 35 and 36, see also Fig. 17, p. 41). This apparatus is so arranged that each objective may be centred individually and it permits of the use of any number of objectives.

It consists of:

a) **The tube-slide.** This is screwed on the end of the body like an ordinary nose-piece with the slide turned towards the front or side. The plane of the slide is not at right angles to the optic axis but is slightly inclined to it.

b) **The objective-slide.** The plane of the slide is inclined to the axis at an angle corresponding to that of the tube-slide. The objective rises therefore on being withdrawn so as not to damage the specimen. At one end of this fitting is a screw, turned by a watch-key, which acts as a stop in bringing the objective always back to the same position and also serves as a centring adjustment in the direction of the slide, while the adjustment in the transverse direction is effected by a similar screw working at right angles to the first.

No.		*Prices in Marks. Code-words.*
	Objectives having their mounts so adjusted as to be approximately in focus when changed can, by means of the screw-collar on the objective slide, be focussed accurately and then fixed once for all in their proper position by a counter-screw collar. Any number of the objective-slides may be supplied together with the tube-slide and others may be added at any time.	
	Tube-slide	10.— **Bamba**
	Objective-slides, each	10.— **Bambaleo**
	We supply special **cases** for these changers, viz:	
	I) **Case for 3 objective-slides and objectives**	6.— **Bambalina**
	II) **Case for 6 objective-slides and objectives** (Fig. 37) .	15.— **Bambarria**

Fig. 37.
Case for 6 objective-slides and objectives.
($^1/_2$ Full Size.)

Appliances for measuring and counting microscopical objects.

A. Measuring Apparatus.

No.		*Prices in Marks. Code-words.*
	With regard to measurements of thicknesses of microscopical objects see p. 33.	
26	**Stage-Micrometer.**	
	a) One millimetre divided into 100 parts; mounted on a glass slip, in case	10.— **Bamboche**
	b) Ten millimetres, the last millimetre divided in tenths .	6.— **Bambonear**
	These micrometers serve merely as standards of known value for determining the micrometer value of the measuring instruments proper.	
	Other divisions on application.	
	See also Nos. 36—38.	
27	**Eye-piece Micrometer** with divisions on a glass disc, to drop into the eye-piece; for measuring the magnified image of an object. The absolute value of the divisions for exact measurements must be determined by means of the stage-micrometer for each objective and eye-piece. Tables are supplied with No. 28 which give approximate values sufficiently accurate for ordinary measurements. In the case of No. 29 they are to be found from the focal lengths of the objectives. In capsule	5.— **Bananero**
	Nos. 28, 28a, 29, 29a are provided with this micrometer (contained in a separate capsule).	
	Eye-piece Cross-line Micrometers are specified below (No. 32).	
	When ordering state whether the micrometer-scale is required for an ordinary or for our micrometer eye-piece.	

No.		*Prices in Marks. Code-words.*
28	**Micrometer Eye-piece for ordinary objectives** (Fig. 38). HUYGHENIAN eye-piece (2 or 3 as desired) with focussing eye-lens for exact adjustment of the micrometer-scale to the eye of the observer; with table of the micrometer values of the divisions. Incl. micrometer-scale No. 27	18.— **Banastada**

Fig. 38. Micrometer Eye-piece.
(Full Size.)

28a	**Micrometer Eye-piece** with a micrometer which can be moved laterally by means of a screw (Vide Fig. 1)	40.— **Bancal**

When using this or any of the following apparatus Nos. 28b, 29a and 29b, 30 and 30a the alteration in the *tube-length* produced should be taken into account (see pp. 3 and 4).

28b	**Micrometer Eye-piece** with movable index (pointer) in lieu of the micrometer-scale	36.— **Bancazo**

The micrometer-disc and the index, which is fixed to a ring and may be obtained separately at **M. 1.—, Banderia,** are supplied in small celluloid capsules together with the eye-pieces. The tube of the eye-piece consists of two parts and may be screwed asunder, the line of division being just above the diaphragm. The ring with either the pointer or the micrometer disc should be placed upon the diaphragm, care being taken that the figures are erect. The eye-piece is then screwed together.

29	***Micrometer Eye-piece for the apochromatic objectives. Compensating Eye-piece 6 with $^1/_1$ micron divisions.** The	

No.		*Prices in Marks. Code-words.*
	divisions in this eye-piece are so computed that with a tube length of 160 mm the value of one interval represents with each apochromatic objective just as many micra, μ (0.001 mm), as there are millimetres in its focal length, i. e.	
	Apochromatic lens: 16 mm 8 mm 4 mm 3 mm 2.5 mm 2 mm 1.5 mm Value of interval: 16 μ 8 μ 4 μ 3 μ 2.5 μ 2 μ 1.5 μ	
	A table of values is superfluous for this eye-piece, since the focus of these lenses indicates these micrometer values accurately within 5%.	**30.— Banderillero**
	If exceptionally exact measurements have to be made the micrometric value of each interval for each objective and eye-piece must be determined with the aid of a stage micrometer (No. 26).	
29a	***Id.** Micrometer-scale laterally adjustable by means of a screw, as with No. 28[a]	**50.— Banderizar**
29b	***Id.** With movable index (pointer) in lieu of micrometer-scale, laterally adjustable as with No. 28[b]	**46.— Bandibula**
110	***Micrometer-Projection-Eye-pieces,** as suggested by Dr. PLAGGE. These eye-pieces form a sharp image of the object as well as a scale reading micro-millimetres (μ). The latter is ruled on a glass slider. In order that the divisions may furnish accurate values the ruling has to be made for each objective separately. When ordering, the latter must therefore be sent to us for adaptation. The glass sliders are made to fit special projection eye-pieces fitted with an adapter which screws into the microscope-tube after unscrewing the draw-tube. These projection eye-pieces are adjusted by focussing the scale instead of the diaphragm.	
	Price of PLAGGE's Projection Eye-piece 2 or 4	**48.— Bandolero**
	Price of each divided glass slider	**6.— Bandosidad**
	Case for 4 glass sliders	**3.— Bangemer**

No. | *Prices in Marks. Code-words.*

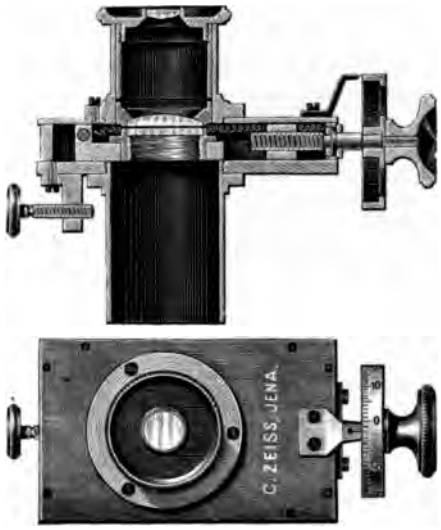


Fig. 39.
Screw Micrometer Eye-piece. Sectional elevation and plan. ($^2/_3$ Full Size.)

30 **Screw Micrometer Eye-piece** (Fig. 39). For exact measurements. RAMSDEN eye-piece; glass-plate with crossed lines which are moved across the field by means of the micrometer screw. The instrument is clamped to the upper tube-end by means of the screw shown on the left side of the figure. — Each interval of the divided drum corresponds to 0.01 millimetre of the objective image. Complete revolutions of the drum are counted by means of a numbered scale seen in the field. The screw is capable of producing a displacement of 4 mm . . . . **90.— Baniano**

In order to fully utilize the high degree of precision of which this instrument is capable, the absolute values corresponding to the divisions of the wheel should be determined by means of a stage-micrometer (No. 26) for each combination of objective and eye-piece.

30a **Id.** fitted with compensating eye-piece in lieu of the RAMSDEN eye-piece; for use with apochromatic lenses . . . . **105.— Banova**

31 **Stage Screw Micrometer** (Fig. 40). For the exact measurement of objects too large for inclusion in one visual

No. | *Prices in Marks. Code-words.*

field of the microscope. — A slider moved by a micrometer-screw carries a rotating disc with divided circle; the divisions of the drum indicate 0.002 mm; complete rotations are counted by an index; the screw measures up to 10 mm. — The instrument is arranged to fix on the stages of stands I[a], II[a] and IV; in the case of the stands fitted with revolving stage this must be removed . . . . . | **120.— Banqueta**

When ordering please to state the breadth of the stage for which it is intended.

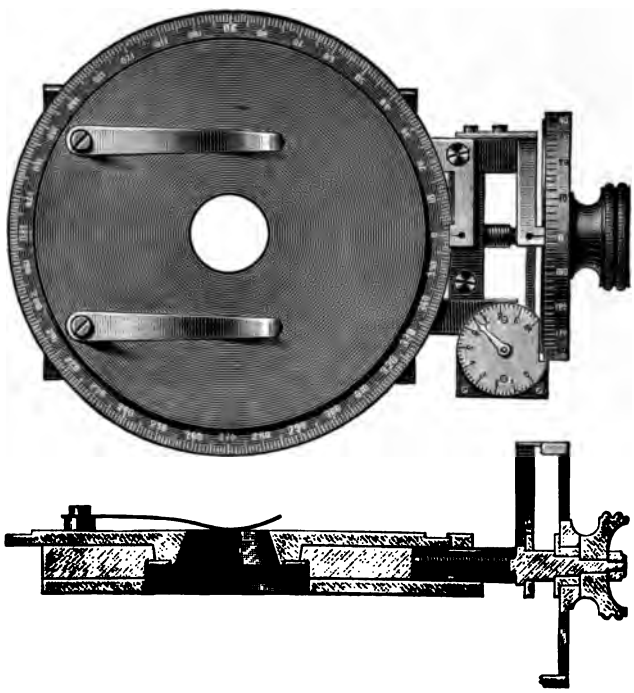


Fig. 40. Stage Screw Micrometer. ($^2/_3$ Full Size.)

40 | **Goniometer Eye-piece,** for measuring the angles of microscopical objects. HUYGHENIAN Ocular No. 2, eye-lens adjustable in a sleeve as with the micrometer eye-piece No. 28. Fitted with glass disc resting on the diaphragm, upon which is ruled a series of parallel lines. With divided circle, which like that of analyser 47[b] (see Fig. 17, T, p. 43) fixes on the upper tube-end | **30.— Banquillo**

40a | **Id.** fitted with Compensating Eye-piece 4 . . . . . | **50.— Banzos**

No.		*Prices in Marks. Code-words.*

Appliances for Counting.

In addition to the Counting Appliances specified below other similar instruments are supplied for special purposes, as described in our leaflet on "Appliances for counting blood-corpuscles, yeast-cells, bacteria etc". This publication may be had free on application.

32	**Eye-piece Cross-line Micrometer,** to rest on the diaphragm of the eye-piece or, preferably, for use with a micrometer eye-piece. This micrometer consists of a glass disc upon which is ruled a square of 5 mm, divided into squares of 1.0 or 0.5 mm, as may be required. It is useful for counting scattered particles in the field. In capsule	5.— **Barahunda**
	When ordering state whether the micrometer-scale is required for an ordinary or our micrometer eye-piece.	
32a	***P. EHRLICH's Set of Stops** of different diameters (1 to 10 mm) for dropping into the eye-pieces, preferably the micrometer eye-pieces	10.— **Baraja**
	1) For determining the numerical ratio of the various white corpuscles in leucaemic blood.	
	2) For determining the relative proportion of red and white corpuscles in cases of anaemia etc.	
	3) The smallest diaphragms for demonstrating objects placed in the centre of the field and also	
	4) For increasing the definition of very fine structural images.	
33	***Counting-Chamber (Cross-line stage micrometer)** with cell of an exact uniform depth of 0.100 mm. At the bottom of the cell are ruled 400 squares each having an area of $^1/_{400}$ square millimetre. The column of fluid resting on each square is, therefore, exactly $^1/_{4000}$ cubic millimetre. With two polished cover-glasses. In case	15.— **Barallar**
	Price of Extra cover-glasses, each	—.75 **Baralloca**
	To meet the requirements of those cases where the blood-corpuscles are not only to be counted but also subjected to microscopic examination under a high power we supply cover-	

No. | *Prices in Marks. Code-words.*

glasses of ordinary thickness (0.18 to 0.20 mm) plane on one side and having their other side cemented to a stout conical glass cell.

Price of cover-glass with conical cell . . . . . **2.— Barangai**

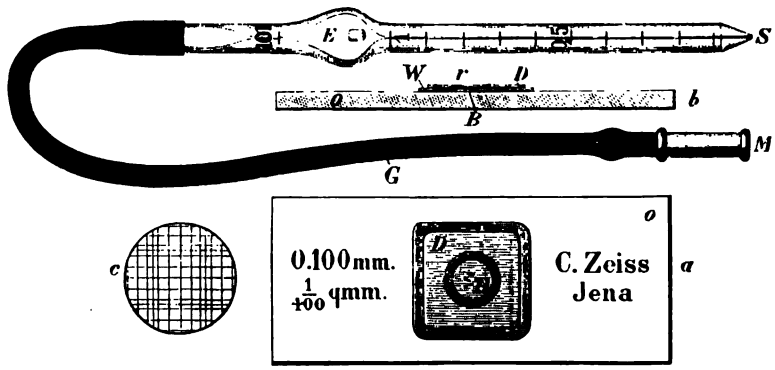


Fig. 41.

Thoma's Haemacytometer. (2/3 Full Size.)

a and *b* counting-chamber, *c* a portion of the ruled bottom of the cell as seen in the eye-piece (Magnif. 30 ×),
S M THOMAS's Mixing pipette for red blood-corpuscles.

34 ***THOMA's Haemacytometer.** (Fig. 41.) This apparatus consists of the above counting-chamber in combination with an accurately calibrated mixing-pipette for diluting the blood in a certain ratio (1 : 100 for red, 1 : 10 for white corpuscles). With directions. In case.

a) **With mixing-pipette for red corpuscles** . . . . . **26.— Baratija**

b) **With mixing-pipette for white corpuscles** . . . . . **26.— Baratura**

c) **The same apparatus with both pipettes** . . . . . **36.— Barbacana**

Pipette separately

for red corpuscles (diluting 1 : 100) . . . . . **9.— Barbado**

for white „ („ 1 : 10) . . . . . **9.— Barbanca**

108 ***MIESCHER's Haemacytometer.** Counting-chamber No. 33 in combination with a specially constructed mixing-pipette (see

No.		*Prices in Marks. Code-words.*
	Correspondenzbl. f. Schweizer Aerzte. Vol. 23, p. 830, 1893). With principal gauge marks for dilutions of $^1/_{100}$, $^1/_{150}$, $^1/_{200}$ and auxiliary marks for accurately estimating any existing faults in the graduation. In case	**32.—** **Barbar**
	Mixing Pipette separately	**14.—** **Barbaresco**
35	**Movable Stage for the Counting-Chamber.** Adapted for stands which are not fitted with a mechanical stage. By its means the counting-chamber is slowly moved in one direction by a screw	**15.—** **Barbaria**

C. Measuring Appliances for various other purposes.

36	**Nickel-silver Rule** 100 $^1/_1$-mm, with bevelled edge . . .	**3.50** **Barbaridad**
37	**Rules on plate-glass,** for measuring drawings, the divisions lying on the surface of the paper without parallax, with fine sharply engraved lines:	
	a) 50 mm divided in $^1/_2$ mm on a 3×1 inch slip	**2.50** **Barbarizar**
	b) 100 mm divided in $^1/_1$ mm, on a glass rule	**3.50** **Barbechar**
	c) 200 mm do. do.	**7.—** **Barberol**
	d) 300 mm do. do.	**12.—** **Barbican**
	Any other scales to orther.	
38	**Rules on plate glass with double scale.**	
	a) Similar to No. 37[a], but with English inches divided into 24 parts at one edge and $^1/_2$ millimetres at the other	**3.50** **Barbillera**
	b) Similar to No. 37[b], but with English inches and $^1/_{12}$ divisions at one edge and $^1/_1$ mm at the other	**4.50** **Barbinegro**

No.		*Prices in Marks. Code-words.*
39	**Fully divided Circles** on plate-glass disc, with bevelled edge and centre-mark, adapted for use as protractors:	
	Circle 80 mm in diameter, $^1/_1$ degrees	10.— **Barbipedo**
	Circle 120 mm in diameter, $^1/_2$ degrees	15.— **Barbirojo**
41	**Cover-glass Gauge** (Fig. 42) for the exact measurement of the thickness of cover-glasses, thin plates etc. — The measurement is effected by a clip projecting from the casing and the reading is given by an indicator moving over a divided circle on the lid of the box. The divisions show hundredths of a millimetre. This gauge measures upwards of 5 mm	30.— **Barbonazo**

Fig. 42.
Cover-glass Gauge. No. 41. ($^2/_3$ Full Size.)

42	**Cover-glass Gauge** of simpler construction; screw with divided disc indicating 0.01 mm	15.— **Barbotar**

Drawing Instruments.

Fig. 43. Abbe's Drawing Camera. No. 43.
(Full. Size.)

No.		*Prices in Marks. Code-words.*
43	***ABBE's Drawing Camera** (Fig. 43). The drawing surface is rendered visible by successive reflection at a large plane mirror and the silvered surface of a small prism situated in the eye-point of the eye-piece. The microscopic image is seen directly through an aperture in the silvering of the prism to which is cemented another prism, both prisms together forming a cube. Thus the pencils of light reach the eye coincidently from the microscope and the paper, and the image and pencil are seen without any straining of the eyes.	

No. | *Prices in Marks. Code-words.*

Since the distance of the large mirror from the ABBE double prism is about 70 mm ($2^3/_4$ in.) an inclined or elevated drawing surface should be used when it is required to draw an extended image free from distortion.

The brightness of the drawing surface is regulated by smoked glasses which fit into grooves in the prism casing.

The camera is attached to the microscope tube by means of three screws and is adjusted for the HUYGHENIAN eye-piece No. 2 and 3 and compensating eye-pieces 4 and 6. It may also be used with very low powers such as the aplanatic lenses No. 79, magnifying 6 and 10 diameters respectively, in conjunction with dissecting stand No. I.

With directions, in case . . . . . **25.— Barbudillo**

Fig. 44.
Abbe's Drawing Camera No. 44.
($^1/_2$ Full Size.)

44 ***The same apparatus** (Fig. 44), so arranged that the prism casing together with the mirror may be swung back, while the clamping collar remains on the tube in its adjusted position. The mirror has a surface of 75 × 50 mm (3 × 2 in.) and may be inclined at any angle between the horizontal plane and 45°, the latter position being marked by a stop. The length of the arm supporting the mirror being 10.5 cm (4 in.), it is only with very large drawings necessary to incline or raise the drawing surface.

With directions, in case . . . . . **35.— Barbullar**

No. | *Prices in Marks. Code-words.*

44a ***ABBE's Drawing Camera,** latest modification (Figs. 45 and 46). (Zeitschr. f. wiss. Mikroskopie, Vol. 11, p. 289, 1894). The camera is attached to the tube by means of the clamping-ring *K* and the ABBE double prism is centred by means of the screws *L* and *H*. The brightness of the drawing surface and the microscopic image are respectively regulated by a cap *R* encasing the prisms, which is provided with a clear opening and 5 moderating glasses of varying degrees of density and by an excentric disc *B* pivoted below the prisms, which is also provided with a clear opening and 5 moderating glasses.

In order to completely utilize the increased cone of emerging rays obtained with low magnifications, the usual prism having in its silvering an aperture of 1 mm can quickly and conveniently be exchanged for another with an aperture of 2 mm (see Fig. 46).

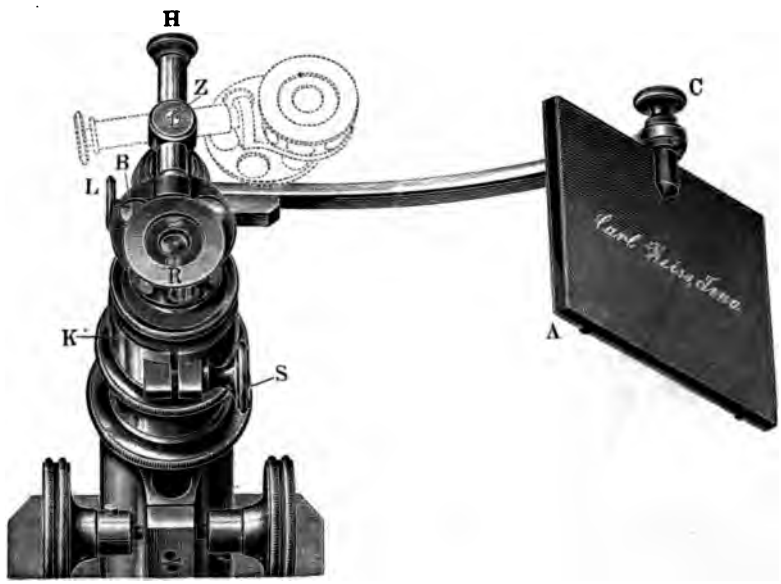


Fig. 45. Abbe's Drawing Camera No. 44a. (2/3 Full Size.)

The prism together with the moderating glasses may be turned aside about the vertical pin *Z* into the position indicated by the dotted lines shown in Fig. 45. When the prism is returned to its original position it is fixed by a catch, which is not externally visible. The size and other features of the mirror are the same as with No. 44.

With instructions, in case . . . . . **60.— Barcada**

No. | *Prices in Marks. Code-words.*

44b ***The same Apparatus,** but adapted for the eye-pieces with increased field of view (HUYGHENIAN Eye-piece 2* and Compensating Eye-piece 4*).

With directions, in case . . . . . **72.— Barcarola**

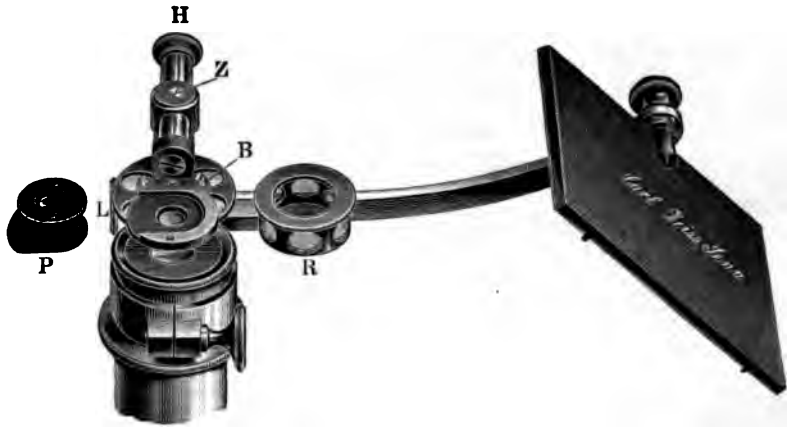


Fig. 46.
Abbe's Drawing Camera No. 44a. (2/3 Full Size.)
Showing ABBE's prism (*P*) and the cap with moderating glasses (*R*) removed.

45 **Drawing Prism** (Camera lucida), old form (Fig. 47), consisting of two prisms *A* and *B*. Attachable to tube-end by means of a sprung collar. As the path of the rays indicated in Fig. 47 shows, the drawing surface should be inclined at 25° to the horizontal plane, when the image is required to be free from distortion.

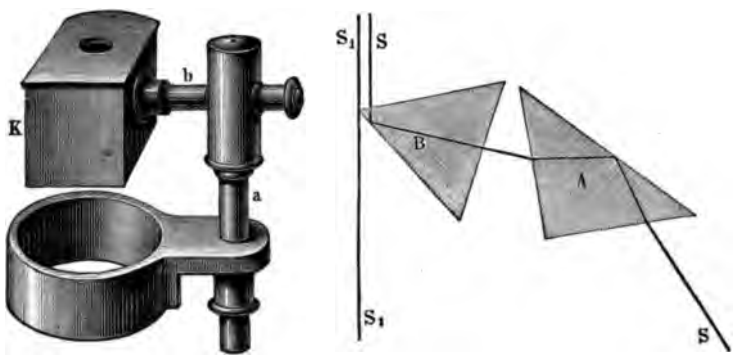


Fig. 47. Drawing Prism No. 45. (3/4 Full Size.)

With instructions, in case . . . . . **21.— Barcella**

No.		*Prices in Marks. Code-words.*
	We supply various forms of **Drawing-Boards** for these Cameras.	
	Simple Drawing-Board, made of soft wood, having the drawing-surface inclined at 25°	**2.50** **Barcino**
105	***BERNHARD's Drawing-Table** (see Zeitschr. f. wissensch. Mikroskopie, Vol. 9, p. 439, 1892 and Vol. 11, p. 298, 1894). The drawing-surface can be raised to a height of 17 cm ($6^3/_4$ in.) and inclined at about 35°. The microscope is clamped to the base of the drawing-table. With arm-rests	**45.—** **Bardado**
105a	***The same,** with arrangement for inclining the microscope together with the drawing-table (Fig. 48)	**52.—** **Bardadura**

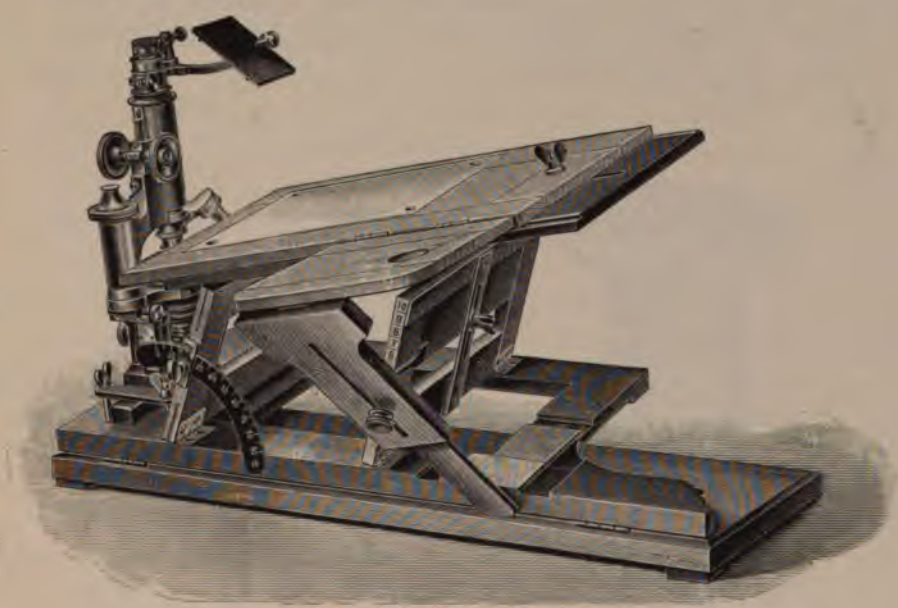


Fig. 48. ($^1/_6$ Full Size.)
Bernhard's Drawing Table No. 105a, with microscope and drawing-camera attached.

Polarizing Apparatus.

No.		*Prices in Mark. Code-words.*
46	**Polarizers:**	
	I. For use with the illuminating apparatus of our large stands. Nicol prism mounted in a flanged cylinder fitting the diaphragm-carrier of the condenser so that the ordinary diaphragms and the selenite and mica films may be placed above the polarizing prism (Fig. 49)	**22.— Bardana**

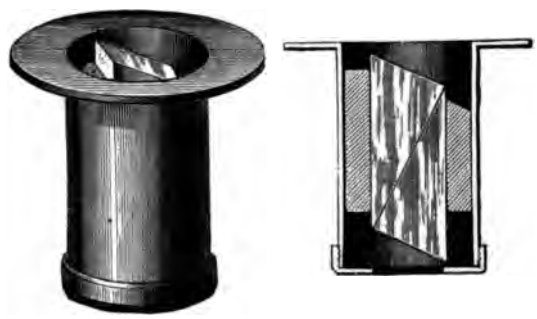


Fig. 49.
Polariser No. 46 I.
(Full Size.)

	II. Fitting the cylinder-diaphragm of the smaller stands. Nicol prism with Condenser No. 19 combined	**25.— Bardasca**
47	**Analyzers:**	
	I. PRAZMOWSKI prism in brass mount, loosely fitting on eye-piece cap	**15.— Baremo**
	II. The same fitted with divided circle (see Fig. 18, *A*, p. 43)	**30.— Barfol**

No.		*Prices in Marks. Code-words.*
47*	***ABBE's Analyzer Eye-piece.** This eye-piece admits of the entire field being viewed at once. It consists of a HUYGHENIAN Eye-piece 2 and Achromatic Analyzing Prism situated between the lenses.	
	I. Without divided circle	**40.— Baricote**
	II. With divided circle	**55.— Barifonia**
	The following sets are adapted for microscopic examination in polarized light:	
48	**Polarizing Apparatus for the large stands fitted** with ABBE illuminating apparatus, viz. Stands I[a] to IV[a]:	
	a) Polarizer I and Analyzer II (with divided circle) . . .	**58.— Barigula**
	b) „ I „ „ I (without divided circle) . .	**41.— Barimetria**
	c) „ I „ ABBE's Analyzer Eye-piece II	**83.— Baritico**
	d) „ I „ ABBE's Analyzer Eye-piece I	**66.— Baritono**
	The above prices include a ***case*** *for these sets.*	
49	**Polarizing Apparatus for the smaller stands** not having the ABBE illuminating apparatus, viz. Stands VI[a] and VII:	
	a) Polarizer II and Analyzer II (with divided circle) . . .	**61.— Barjoleta**
	b) „ II „ „ I (without divided circle) . .	**44.— Barleria**
	c) „ II „ ABBE's Analyzer Eye-piece II	**86.— Barlovento**
	d) „ II „ ABBE's Analyzer Eye-piece I	**69.— Barnabita**
	The above prices include a ***case*** *for these sets.*	
	The upper part of the analyzers No. 47 can be screwed upon the Projection Eye-pieces 2 and 4 (but **not** upon Projection Eye-piece 2*) after unscrewing the cap of the eye-lens. For projections without the eye-piece, at very low magnifications, we supply to order an **Analyzer-Prism, which by means of an adapter is suspended above the objective**. Price M. 25.—. **Barnaclo.**	
	Possessors of a divided circle, such as that of the goniometer eye-piece No. 40, may use it in conjunction with the analyzer. The price of the polarizing apparatus is in this case the same as that of the polarizing apparatus without divided circle, plus Mk. 3.— for the adaptation of the analyser.	
	The divided circle must be sent to the works for this purpose.	
50	**Eye-piece for observing axial images** (Fig. 50). HUYGHENIAN Eye-piece No. 2 with sliding eye-lens combined with a collective system consisting of two single lenses the lower one of which, by means of a sliding tube, can be focussed with respect to the upper focal plane of the objective	**30.— Barniz**

No. | *Prices in Marks. Code-words.*

50a

Fig. 50. Eye-piece for axial images. (1/2 Full Size.)

We supply also, to order, an **Eye-piece for observing axial images,** of a **modified** form introduced **by Dr. CZAPSKI,** fitted with iris-diaphragm above the achromatic object-glass and a mechanical measuring appliance forming part of the eye-piece proper. The latter is interchangeable for a BRÜCKE lens, which forms a sharp image of the image of the crystal within the aperture of the iris-diaphragm, as in the case of No. 52. A detailed description and notice of its price will shortly be published in the Zeitschrift für Krystallographie.

51 **MOHL's Set** of **8 Selenite** and **Mica Films.** (These films are only adapted for use with the large ABBE illuminator of Stands I[a] to IV[a]) . . . . . **10.— Barnizado**

52 ***CZAPSKI's Iris-diaphragm with Eye-piece** (Fig. 51). (Zeitschr. f. Krystallogr. Vol. 22, p. 158, 1893.) For examining and accurately identifying the axial images of small crystals. It consists of a small iris-diaphragm fitting into the upper end of the tube, a sleeve attached to the mount of the iris-diaphragm and a RAMSDEN eye-piece sliding in the sleeve from the top and adjustable so as to have the iris-diaphragm in its focus. The crystal which is to be examined having been accurately centred by means of the eye-piece the other portions of the image are cut off by the iris-diaphragm, for observing axial images the eye-piece is then removed and replaced by the analyzer, or the latter is slipped into the tube, as the case may be.

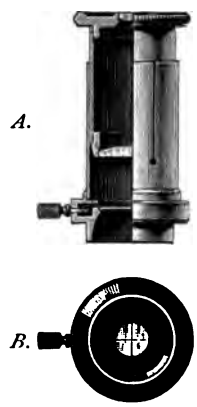


Fig. 51. Czapski's Iris-diaphragm with Eye-piece.
A. Longitudinal section and side elevation.
B. Iris-diaphragm viewed from above.
(1/2 Full Size.)

With ruled cross-lines immediately below the iris . . . . **25.— Baronal**

Spectro-polarizer, see No. 23, p. 63.

Spectroscopic Eye-pieces.

No. | *Prices in Marks. Code-words.*

53 ***ABBE's Spectroscopic Eye-piece (Micro-Spectroscope)** (Figs. 52 and 53), specially constructed for the examination of absorption spectra of microscopic objects but also adapted for spectroscopic analysis of liquids. — The achromatic upper lens

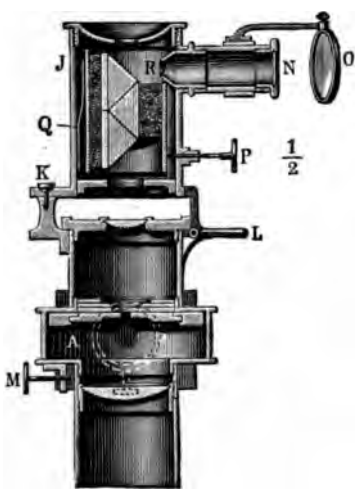


Fig. 52. Abbe's Micro-spectroscope. Longitudinal Section of the whole instrument. (1/2 Full Size.)

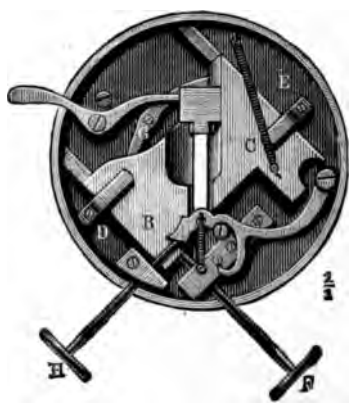


Fig. 53. Slit Mechanism separately. (Plan view, Full Size.)

is accurately adjustable with respect to the slit situated between the lenses. The mechanism for contracting and dilating the slit is actuated by the screw *F* and causes the laminae to move symmetrically (MERZ's movement). The slit opens sufficiently

No.		*Prices in Marks. Code-words.*
	wide so as to include the whole visual field. The screw *H* serves to limit the length of the slit so as to completely fill the latter with the image of the object under investigation when the comparison prism is inserted. The comparison prism is provided with a lateral frame and clips to hold the object and the illuminating mirror. All these parts together with the eye-piece are encased in a drum. Above the eye-piece is placed an AMICI prism of great dispersion which may be turned aside about the pivot *K*, so as to control the adjustment of the object, the prism being retained in its axial position by the spring catch *L*. A scale is projected on the spectrum by means of a scale-tube and mirror attached to the prism-casing. The divisions of the scale indicate in decimals of a micron the wave-length of the respective section of the spectrum. The screw *P* serves to adjust the scale relative to the spectrum. The instrument is inserted in the tube in place of the ordinary eye-piece and is clamped to the former by means of the screw *M* in such a position that the mirrors *A* and *O*, which respectively serve to illuminate the comparison prisms and the scale of wave-lengths, are simultaneously illuminated by sunlight. In case, together with a number of lithographed scales for recording observations	**200.— Baronesa**
54	***ENGELMANN's Micro-Spectro-Photometer** for quantitative micro-spectrum analysis, constructed on the principle of VIERORDT's spectro-photometers (see Zeitschr. f. wissensch. Mikrosk., Vol. 5, p. 289, 1889)	**480.— Baroscopio**
	A short description of this instrument in German may be had on application.	

Various Optical and Mechanical Accessories.

No. 55

Prices in Marks. Code-words.

***ABBE's Stereoscopic Eye-piece** (Fig. 54), for stereoscopic and ordinary binocular observation of microscopical objects with any desired magnification (CARL's Repertorium d. Experimentalphysik, 1881, p. 298; Journ. of the R. Micr. Soc. 1881, p. 203). The division of the pencil of rays emerging from the objective, with the object of producing two separate images, is effected at the upper end of the tube by partial reflection at a thin stratum of air[1]) between two opposed glass prisms; the bisection of the pencils for producing stereoscopic effects is made by adjustable semi-circular stops placed above the eye-pieces; without these the instrument gives binocular vision without specific stereoscopic effect. The distance between the eye-pieces is adjustable to suit the inter-ocular range of the observer's eyes. The instrument is available for low and high powers of the achro-

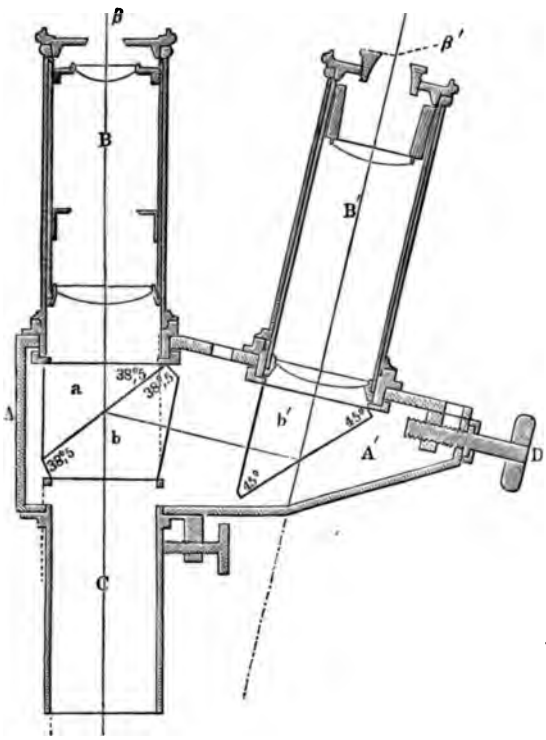


Fig. 54.
Abbe's Stereoscopic Eye-piece.
(2/3 Full Size.)

[1]) By a method proposed by L. MACH we have recently succeeded in reducing the stratum of air to about 0.001 mm, whereby we have been enabled to obviate the appearance of double images in the eye-piece B', which formerly was an inconvenient feature of this instrument, and at the same time to considerably increase the brightness of the images.

No.		*Prices in Marks. Code-words.*
	matic type only, on any large stand provided with rack and pinion coarse adjustment and permitting of the body being shortened to at least 140 mm ($5^1/_2$ inches). In mahogany case .	180.— **Barquero**
	In ordering this binocular apparatus for any microscope which is not of our make it will be necessary to send a sharp sealing-wax impression of the upper end of the tube.	
56	**AMICI Erecting Prism** ("prisme redresseur") for obtaining erect images when using the compound microscope as a dissecting microscope. The optic axis (direction of vision) being displaced about 30° from the axis of the tube the head remains in a convenient posture. In flanged mount loosely fitting eye-piece No. 2	25.— **Barquilla**
57	***Erecting Eye-piece fitted with Porro's Prisms.** This eye-piece fits into the tube like an ordinary eye-piece. It contains encased in a drum the PORRO prisms, below these is the sleeve fitting the tube of the microscope and above is another sleeve which takes any eye-piece and whose axis is parallel but laterally displaced with respect to that of the tube. In case	40.— **Barquinazo**
58	***ABBE's Diffraction-Plate,** for demonstrating the effects of diffraction in the formation of microscopical images (Monthly Micr. Journ., 1877, p. 82; DIPPEL, Mikroskop, p. 144). Three cover-glasses silvered at their lower surfaces and having groups of lines ruled upon them so as to form simple and crossed gratings, cemented side by side on a glass slip with a set of stops and a fitting for rotating them above the objective. Adapted for the objective aa	20.— **Barrachel**
58a	**Diffraction-plate** separately	8.— **Barrado**
59	**Artificial Illuminating Appliances for the Microscope.** Incandescent Gas Lamp with ordinary burner and Jena glass chimney mounted on a brass stand, adjustable in height, together with a spherical glass flask of about 150 mm (6 in.) diameter (No. 59a), which	

No.		*Prices in Marks. Code-words.*
	when filled with water or dilute ammonio-cupric sulphate solution serves as a collective lens.	
	To obtain proper illumination the gas flame should be about 15 cm (6 in.) behind the flask and the mirror of the microscope at the same distance in front of it and having the brightest part of the cone of light falling upon it. The apparatus supplies an excellent bright and white light which almost completely supplants day-light. Including 2 spare mantles	22.— **Barragan**
59a	**Spherical Glass Flask** with frame, separately	7.— **Barrate**
60	**BROWNING's Hand-Spectroscope** (Pocket spectroscope) for observing the effect of absorption in large objects (e. g. troughs filled with blood). With adjustable slit and AMICI prism of high dispersion.	
	a) Without comparison prism	40.— **Barredero**
	b) With comparison prism	46.— **Barrenador**
	c) With comparison prism and wave-length scale	80.— **Barrenilla**
	A separate description of larger spectroscopes of special construction may be had on application.	

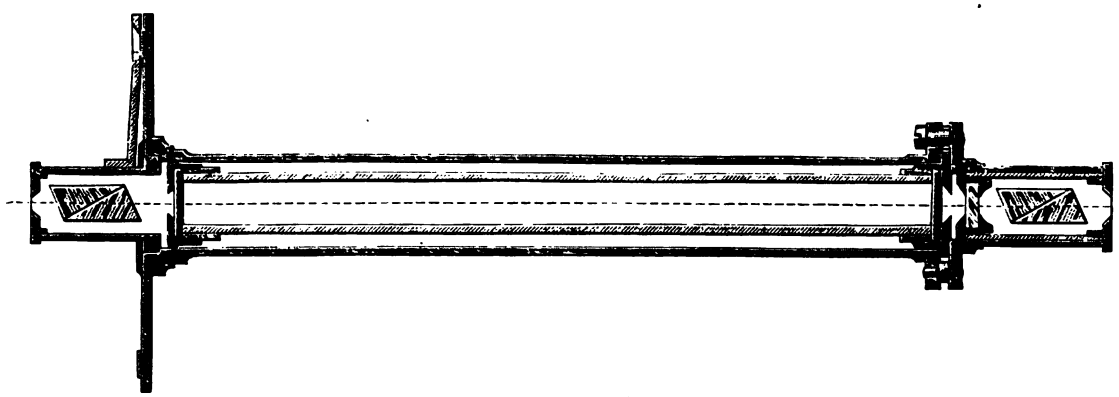


Fig. 55. Saccharometer No. 61. (1/2 Full Size.)

61	**Saccharometer** (Fig. 55), for estimating the percentage of sugar in liquids. — With tube 200 mm long sliding in a brass tube, which carries a polarizer and double quartz plate at one end and at the other an analyzer with divided circle. The circle is divided into 1/2 degrees and tenths can be estimated with accuracy by means of a vernier. Observation is made by ad-	

No.		*Prices in Marks. Code-words.*
	justing the so-called transition colour in both halves of the quartz plate, the tube being held against a white surface. Only suitable for fluids containing a small percentage of sugar. With directions	**90.— Barretear**
61a	**The same with small telescope** for the more exact observation of the double quartz plate	**108.— Barrilame**
62	***PFEIFFER's Warm Chamber** for heating microscopical objects during observation (Fig. 56).	

Fig. 56.
Warm Chamber. ($^1/_6$ Full size.)

This chamber consists of a mahogany box encasing the whole of the stand. In the front it is provided with a glass window to admit the necessary light. On either side there is a closely fitting door through which the specimen can be moved with the

No.		*Prices in Marks. Code-words.*
	fingers. The whole is mounted on a thick metal plate and tripod. The former is heated from below by a micro-burner in conjunction with a thermo-regulator.	
	By this means the whole stand and the air surrounding it are maintained at the required temperature and the indications of the thermometer placed in the air space correspond with the actual temperature of the object on the stage.	
	The temperature may be raised to 45° C without risk of injury to the stand or lenses.	
	Price of the warm chamber incl. special thermo-regulator adjustable for temperatures from 25° to 50° C:	
	a) For large stands (I[a], Mineralogical and Photo-micrographic Stand)	70.— **Barriondo**
	b) For medium stands (II[a]—IV[b])	60.— **Barriscar**
	Micro-burner, burning with smokeless flame	4.50 **Barrizal**
	Price of the **thermo-regulator** separately	10.— **Barrotin**
	We are also prepared to supply, at original prices, the following two heating stages manufactured by Messrs. E. LEYBOLD's Nachf.:	
106	**L. PFEIFFER's Heating Stage.** This stage consists of a glass box made by the LEYBOLD sealing process, which may be directly used as an object slide. With thermometer and inlet and outlet tubes for suitably heated water	9.— **Barule**
106a	**The same** with 3 concavities at the upper glass surface, upon which the cover-glasses are placed for hanging drop observations	15.— **Barzon**
	Thermo-regulator for these stages	10.— **Barzonear**
	ZOTH's direct cooling trough may, if desired, be fitted with a thermometer and will in this form be found to serve as a useful heating stage, especially if it be required to *alter the temperature* in the course of observation	18.— **Basa**
63	**Turn-Table** on wood base for ringing specimens	11.— **Basacula**

No. | *Prices in Marks. Code-words.*

64 ***Attachable mechanical stage** (Fig. 57). This mechanical stage can be readily attached to Stands II[a], IV[a] and IV[b].

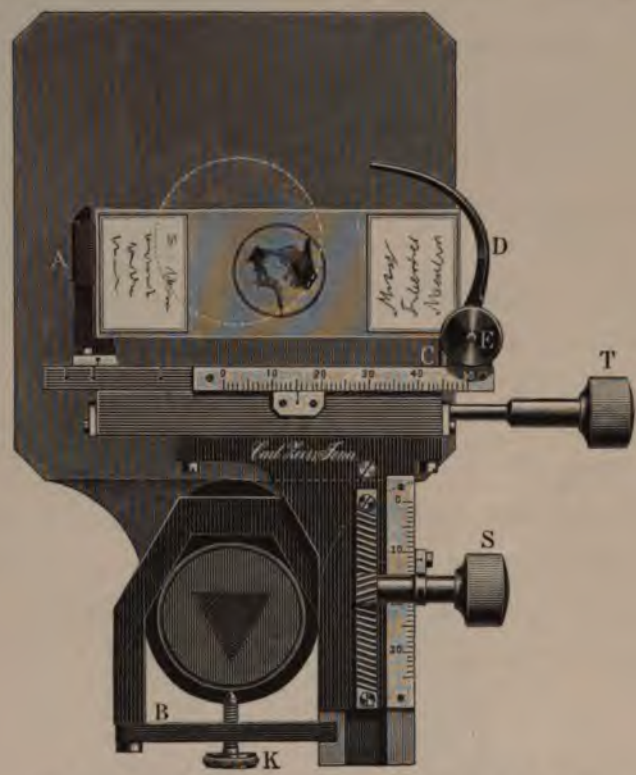


Fig. 57. Attachable mechanical stage. (2/3 Full Size.)

This stage is in principle similar to those designed by MAYALL and later on by REICHERT. Two sliding pieces mounted at right angles to one another are moved by means of two milled-heads *S, T.* These sliding pieces pass along millimetre scales which serve to record any particular position. The range of the rack and pinion movement is 30 mm, that of the lateral movement 50 mm; the reading is taken with the aid of a vernier reading tenths of a millimetre (not plain pointer as shown in the figure).

The object-slide, which may be of any size, always remains in immediate contact with the stage of the microscope stand, which is imperative if the illuminating apparatus is to exercise its full efficiency . . . . . **85.— Basamento**

Case for this stage . . . . . **5.— Bascongado**

Dissecting Microscopes and Hand Lenses.

Dissecting Stands.

No.		*Prices in Marks. Code-words.*
70	***Dissecting Stand I** as suggested by **PAUL MAYER** (Fig. 58). Heavy horseshoe foot. The stage consists of a large metal frame (10 × 10 cm = 4 × 4 in.) to which are attached wooden folding hand-rests; adjustment by rack and pinion; plane and concave mirrors with universal motions, to which a piece of white paper may be attached by means of a ring so as to produce diffuse illumination with low magnifications. The Triple Dissecting Lens No. 76 forms a suitable combination for dissecting and "teasing" small objects on a slide or in a watch-glass; it may be fixed in the ordinary lens-holder *P*, and a black metal plate with stage opening of 14 mm dia., which can be closed below by a black or white disc, may be slipped under the object into a recess provided in the stage-frame. For examining large objects, particularly living aquatic animals, the Aplanatic Lenses Nos. 78 and 79 (6 and 10 dia.) will be found useful; they fit into a separate arm *LR* which may be inserted into the ordinary lens support at *L* and by this arrangement the whole of the stage can be examined.	

No. | *Prices in Marks. Code-words.*

In this case the metal stage is replaced by a glass plate and interchangeable white and black discs made to swing round pivot *A* serve as convenient means of forming a white or black ground.

A brass plate made to fit the frame serves as a support for small dissecting dishes, which may be attached to it with paraffin.

Similarly, Dissecting lens No. 76 can be slipped into the ring *R* attached to the arm *LR*, by means of which it can be passed over the entire stage.

Respecting the use of the ABBE drawing-camera with this stand see p. 78.

The whole instrument in mahogany case fitted with lock and handle.

Without lenses . . . . . 125.— Baseuense

Fig. 58. Dissecting Stand I.
(1/3 Full Size.)

111 ***GREENOUGH's Binocular Microscope** (see Zeitschr. f. wiss. Mikr. Vol. XIV, pp. 289—312, 1897). This microscope has been designed with a view to facilitate the examination and preparation of small solid objects, such as seeds, crystals, eggs, larvae etc.,

No. | *Prices in Marks. Code-words.*

by furnishing an accurate solid and erect image. The advantages of such an instrument will, more particularly, appeal to zoologists, botanists and embryologists. For this purpose an instrument has been contrived consisting of a combination of PORRO prisms with a compound microscope of the usual optical type. The instrument possesses therefore the characteristic advantages of the compound microscope over simple lenses, whilst through the interposition of the PORRO prisms the inverted image is rendered erect. Binocular stereoscopic vision is obtained, not, as in the usual form of binocular microscope, by the subsequent division of a pencil of light passing through one object-glass; but two complete microscopes, each having its own objective and eye-pieces, are simultaneously directed upon the object. It is only on this principle that stereoscopically correct images (orthomorphic vision) can be obtained; on the other hand it is applicable to comparatively low powers only. This is not a fatal objection since an instrument of this kind would be almost exclusively limited to low power work. The application of PORRO's prisms affords a convenient means of adjusting the inter-ocular distance, without which an instrument intended for stereoscopic vision is practically useless.

The stand (Fig. 59) has more or less the appearance of our monocular Stand IX. The round stage of this stand has however been replaced by a square stage resembling that of PAUL MAYER's Dissecting Stand (No. 70) and adapted for its special purpose. The double tube is moved up or down by a solid rack and pinion adjustment *T*. The construction of this stand is described in detail in the Zeitschr. f. wiss. Mikrosk., loc. cit., (Reprints may be had on application). The objectives B_1 B_2 are attached to a sliding frame *S*. The two eye-pieces C_1 C_2, being excentrically mounted upon a vertical axis on the prism-casing P_1 P_2, can be easily adjusted by hand so as to suit any inter-pupillary distance within the normal limits of 56 and 76 mm ($2^1/_4$ to 3 inches). In all cases where the eyes are abnormally wide apart or near together the actual inter-ocular distance should be specified when ordering.

Fig. 59.
Greenough's Binocular Microscope.
($^2/_5$ Full Size.)

No.		*Prices in Marks. Code-words.*
	We supply two special eye-pieces of different powers corresponding to our HUYGHENIAN Eye-pieces 2 and 4. We describe them accordingly as Orthomorphic Eye-pieces 2 and 4 respectively. The magnifications resulting from the combination of these eye-pieces with the objective are respectively 25 and 40.	
	Price of the microscope including a pair of objectives and eye-pieces, in mahogany case	255.— **Balbas**
	Price of a pair of eye-pieces with drop-in stops	20.— **Balbucear**
112	***GREENOUGH's Microscope with universally movable dissecting-stand, as modified by BRAUS-DRÜNER,** see Figs. 60 and 61. (Zeitschr. f. wiss. Mikr., Vol. XIV, pp. 5—10, 1897.) This microscope is principally adapted for the delicate preparation of objects which are too large to be dealt with on the stage of microscopes. It is also excellently adapted for pond-life studies and for the observation of vegetable growth, of small crystals embedded in other minerals etc., in fact for the microscopic examination of small areas included within more extensive objects which cannot be dissected.	
	The optical arrangement is the same as that of GREENOUGH'S Microscope. On the other hand the double tube is fixed in such a manner that, when required, it can be moved round an axis at right angles to the plane passing through the two optic axes of the tubes, so as to place one of the tubes in a parallel line with the original centre-line of the binocular microscope, i. e. in a vertical position with respect to the general plane of the object. By this arrangement it is possible to employ the microscope as a monocular microscope in conjunction with higher powers. For this purpose the stand is provided with an extra sliding-piece S_2 fitted with the "Society" screw, which when in position closes the opening of the other tube.	
	The stand is mounted on a heavy oblong foot and is fitted with very smoothly working rack and pinion movements T_1 T_2 T_3 for adjustment in three directions at right angles to each other.	

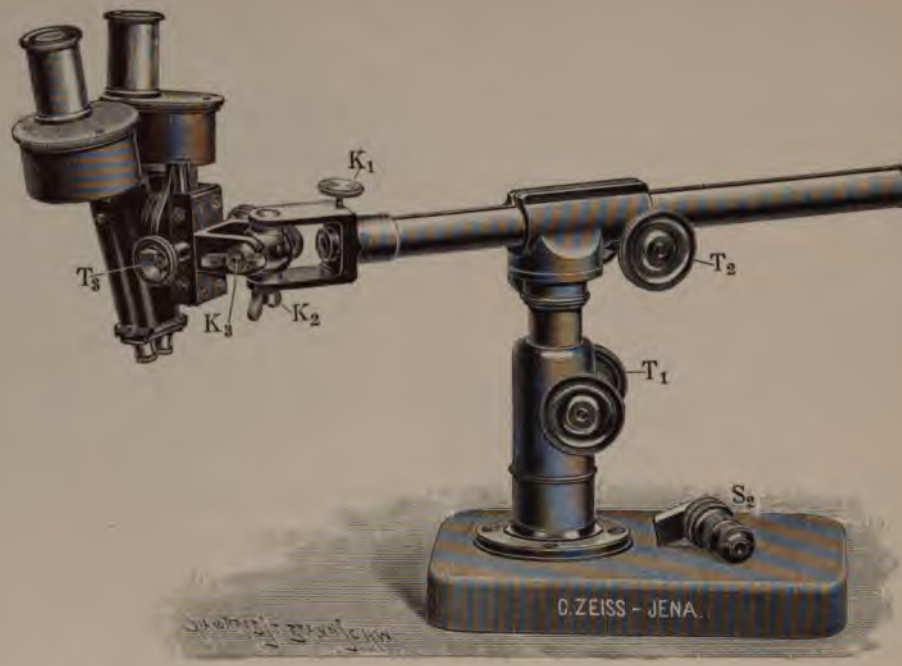


Fig. 60.
Braus-Drüner's Universally Movable Dissecting Microscope. (1/4 Full Size.)

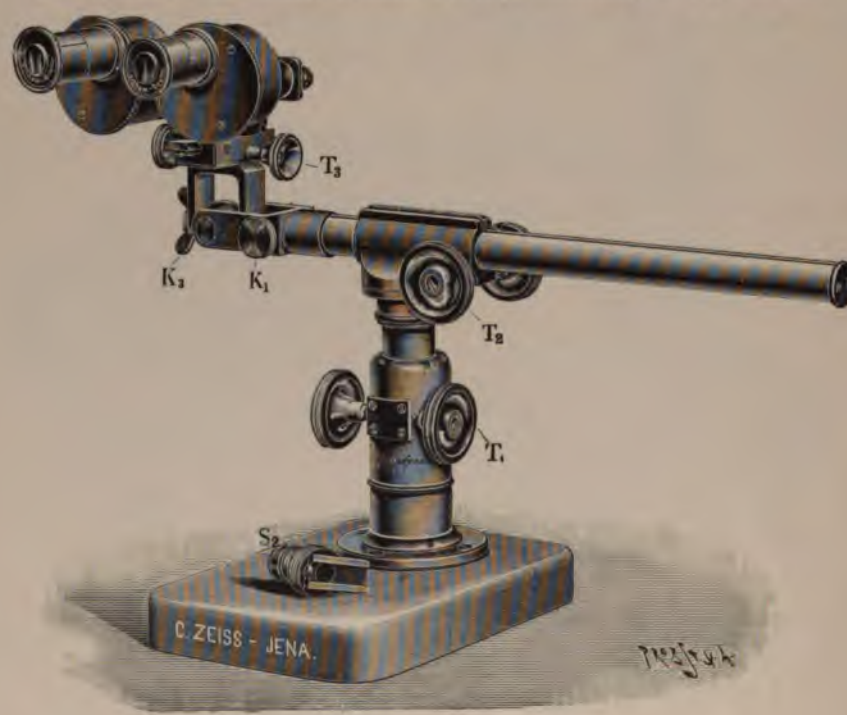


Fig. 61.
Braus-Drüner's Universally Movable Dissecting Microscope. (1/4 Full Size.)

No. | *Prices in Marks. Code-words.*

Apart from these adjustments the whole of the fitting carrying the tubes can be rotated on three axes at right angles to each other. These rotary movements are fixed by three clamping-screws K_1 K_2 K_3. By the appropriate use of these movements every point of any object however irregular can be brought under observation. There is a fourth movement which serves the purpose of effecting rapid changes of position. The vertical axis of this movement coincides with the centre-line of the main column and is fixed by a clamping-screw K_4.

Price of the Microscope including a pair of objectives and eye-pieces, in plain box . . . . . 340.— **Balbuzardo**

This microscope is not provided with a stage. In those cases where the microscope is required for dissection in transmitted light the addition of our Dissecting Stand I is recommended.

In accordance with Mr. GREENOUGH's suggestions we make the following two accessory appliances, which are more especially designed to meet the requirements of zoologists and embryologists. They serve the purpose of facilitating and controlling the movements of the object round one or several centres, so as to view it from all sides, and as an aid in correct drawing and reconstructions.

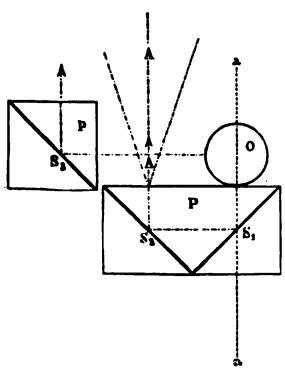
113 

Fig. 62. Prism-rotator. Sectional diagram.

***Prism-rotator** (see Zeitschr. für wiss. Mikroskopie, Vol. XIV, p. 304) Figs. 62 and 63. This apparatus is adapted for viewing from all sides, at low magnifications, large objects, in air or water, illuminated by incident light, without necessitating any alteration in the position of the object with respect to its support. This accessory will, accordingly, be found particularly useful for the examination from all sides of such objects as are too delicate or precious to admit of any preparation. By means of a rotating base and multiple reflections at silvered prism surfaces the object is optically placed in such a position

No. | *Prices in Marks. Code-words.*

that it may be examined from above or below, or any other point. Fig. 62 illustrates the path of the rays. Fig. 63 gives a general view of the instrument.

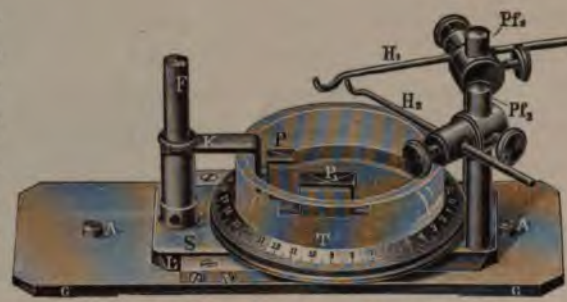


Fig. 63. Prism-rotator. (2/3 Full Size.)

With directions, in case . . . . . **72.— Balconazo**

113a ***Prism-rotator** with double side-view reflection. In the ordinary form of the Prism-rotator, as above described, the positions of "right" and "left" are reversed in the side-views on account of the odd number of reflections. In certain cases, such as artistic reconstruction, this is inconvenient. To meet the requirements of these cases we construct also a Prism-rotator having an additional prism which corrects this defect. With directions . . . . . **90.— Baldado**

114 ***Capillary Rotator** (see Zeitschr. für wissenschaftl. Mikroskopie, Vol. XIV, pag. 309). Fig. 64. The instrument serves to rotate

Fig. 64. Capillary Rotator. (3/5 Full Size.)

very small objects (larvae, stages of segmentation) about a horizontal axis. The objects are examined in small glass tubes which with the part containing the object are immersed in cedar-wood oil, so as to obviate irregular refraction. This apparatus is principally intended for observation with immersion lenses.

With directions, in case . . . . . **60.— Baldaqui**

No.		*Prices in Marks. Code-words.*
71	***Dissecting Stand III** (Fig. 65). Heavy square metal base, large stage, 75 × 60 mm (3 × 2 3/8 "), to which are attached leather covered hand-rests *B*. Adjustment by rack and pinion; large concave mirror. Adapted for Dissecting lenses Nos. 76 and 78 (10 and 20 dia.).	

Fig. 65.
Dissecting Stand III. (1/2 Full Size.)

A separate lens-holder is required for Lens No. 79 (6 and 10 dia.). (Price of this holder **M. 4.—, Bascula.**) The arm is inserted at *A* in place of the usual lens-carrier. It is shown together with the lens in Fig. 65, at the foot of the stand, (at *L*).

In case fitted with lock and handle.

Without lenses . . . . . **70.— Baseologia**

No. | *Prices in Marks. Code-words.*

Fig. 66. Dissecting Stand V. (1/2 Full Size.)

73 **Dissecting Stand V** (Fig. 66). Small brass stand with stage, above which a lens slides up and down in a holder.

a) With block for supporting the hands . . . . . **14.— Basilicar**

b) Without this block . . . . . **12.— Basiliano**

Adapted for use with Lenses Nos. 81 and 82 or Doublet No. 80 (15 and 30 dia.) only.

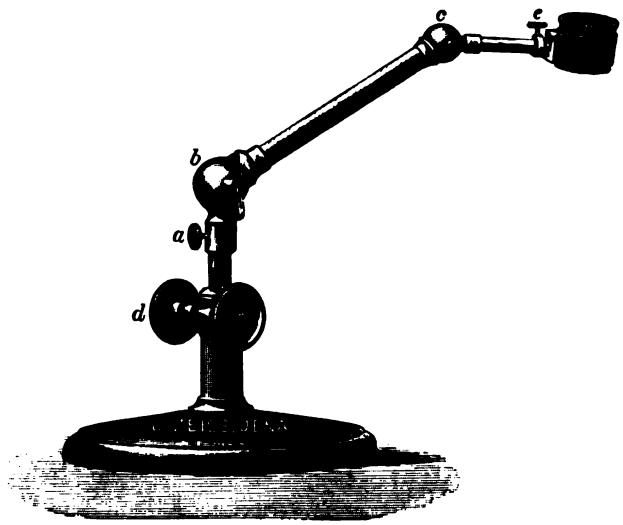


Fig. 67. Lens-Holder I. (1/3 Full Size.)

74 ***Lens-Holder I** (Fig. 67). Heavy metal foot, lens-holder with hinge-joints, rack and pinion for focussing.

No.		*Prices in Marks. Code-words.*
	The holder rotates on a vertical axis fitted with a clamping-screw *a*, by which means the lens can be passed over an extended area without interfering with the adjustment. The vertical adjustments are effected by two joints *b* and *c*, which can be fixed by means of a clamping-screw *d* (see Ztschr. f. Instrkde., Vol. XV, 1895, p. 322 et seq., and Ztschr. f. wiss. Mikr. Vol. XII. p. 318.) .	**40.—** **Basoca**

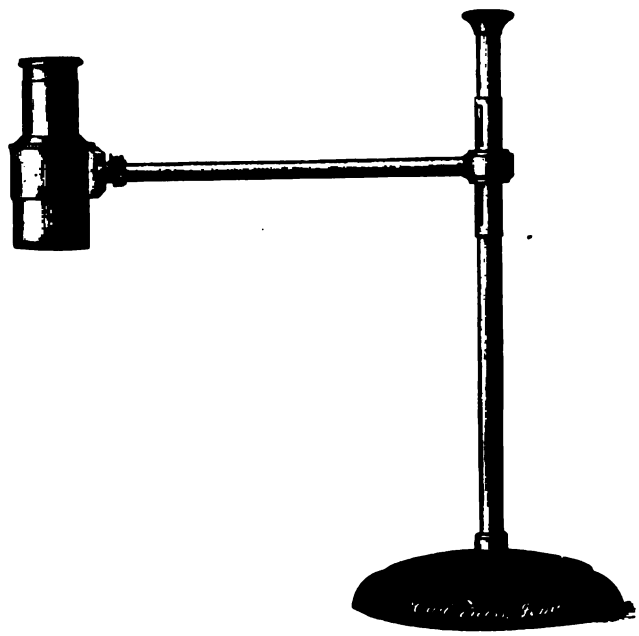


Fig. 68.
Lens-Holder II. ($^1/_3$ Full Size.)

75	**Lens-Holder II** (Fig. 68). Heavy metal foot with vertical brass rod and sliding lens-holder without joints	**15.—** **Bastado**

This lens-holder is specially adapted for the BRÜCKE lenses Nos. 83 and 84, but can also be employed with other low power lenses (Nos. 79 and 81).

Dissecting-Lenses and Hand-Magnifiers.

No.		*Prices in Marks. Code-words.*
76	***Dissecting Combination-Lens** (see p. 101, Fig. 65, *P*), consisting of three achromatic lenses (objective) and an achromatic concave eye-piece; magnifying 100 diameters and having a focal distance of 9 mm, which affords ample room for convenient manipulation with scalpels and needles during observation	40.— **Bastanza**

By unscrewing the third and second lenses of the objective and using the latter without the eye-piece a useful series of graduated magnifications may be obtained, as shown in the following table:

			Magnification
3	lenses	with eye-piece	100 diameters
2	„	„ „	60 „
1	„	„ „	40 „
3	„	without „	30 „
2	„	„ „	20 „
1	„	„ „	15 „

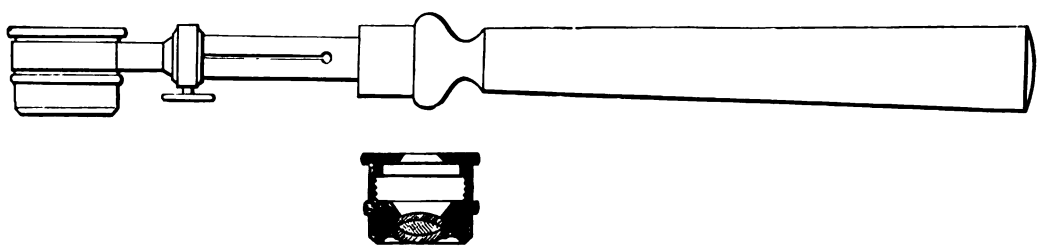


Fig. 69. (Full Size.)
Steinheil Aplanatic Lens with Handle (20 ×).

78	**Aplanatic Lenses** (Fig. 69). STEINHEIL's formula, composed of three cemented lenses, giving relatively long working distances with large flat fields. The higher powers are adapted for use with the dissecting microscopes, the lower ones as hand lenses or with a lens-holder. Magnifying 6, 12, 20, 30 ×, in wood capsule, each		
		Magnif. 6 ×	15.— **Bastar**
		„ 12 ×	15.— **Bastardear**
		„ 20 ×	12.— **Bastardelo**
		„ 30 ×	12.— **Basterna**

No.		*Prices in Marks. Code-words.*
79	***Improved Aplanatic Lenses** (Fig. 70, see also Figs. 58, 65 and 67). Of similar construction, with **exceptionally large field,** adapted for use with ABBE cameras No. 43 and 44 without the need of an adapter, (see p. 78) and with Camera 44a, which necessitates an adapter. Price of this adapter: Marks **2.— Bastilla.** Magnifications 6 and 10 ×. Each in wood capsule.	
	Magnif. 6 ×	**18.— Bastonazo**
	„ 10 ×	**18.— Batalla**

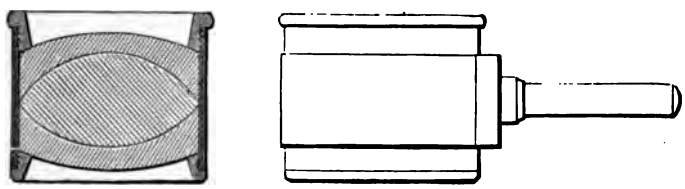


Fig. 70. Improved Aplanatic Lens 6 ×. (Full Size.)

	Handle with ring for lenses 78 and 79 (see Fig. 69) . .	**3.— Batedores**
	Tripod for same	**3.— Bateria**

Fig. 71. Folding Lens No. 79a. (Full Size.)

79a	**Folding lens** (Fig. 71), being lens No. 79 in metal folding mount . . . . . Magnif. 6 ×	**21.— Baticol**
	„ 10 ×	**21.— Batidera**

No.		*Prices in Marks. Code-words.*
80	**Doublets,** old formula. a) 15 ×, in case	6.— **Batifulla**
	b) 30 ×, „ „	6.— **Batimiento**
	Adapted for Dissecting Stand V (see Fig. 66). Not suitable for free hand use owing to their high power.	
81	**Magnifier,** two lenses in brass mount, magnifying 10 ×, lower lens alone 5 ×, in capsule	6.— **Batintin**
	Adapted for Dissecting Stand V, and also as a hand-magnifier (see Fig. 66).	
82	**Magnifier,** same construction simplified, for Dissecting Stand V, in wood capsule	5.— **Batiportas**
83	**Small BRÜCKE Dissecting Lens** with long focal distance, magnifying 4 to 5 times	16.— **Batochar**
84	**Large BRÜCKE Dissecting Lens,** double objective having achromatic lenses of 33 mm aperture and a sliding eye-piece, magnifying 5 to 10 times (see Fig. 68)	25.— **Batologia**
	Lenses Nos. 83 and 84 are specially adapted for the Lens-holders Nos. I and II (see Figs. 67 and 68).	
87	**Achromatic Magnifier,** in ivory folding mount, with two achromatic lenses; magnifying 3, 5 and 10 ×	12.— **Batraca**
88	**Algascope.** Lens magnifying 120 ×, with glass plate for supporting the object and focussing-screw	8.— **Baturrillo**

Synopsis of Magnifiers.

No.	Type	Magnification	Working distance mm	Visual field mm	Price Mk.	Code-words.
78	STEINHEIL aplanatic lenses	6	34	18	15.—	**Bastar**
		12	20	9	15.—	**Bastardear**
		20	10	3.5	12.—	**Bastardelo**
		30	7	2	12.—	**Basterna**
79	Improved aplanatic lenses	6	32	30	18.—	**Bastonazo**
		10	12	15	18.—	**Batalla**
80	Doublet a)	17	13	4	6.—	**Batifulla**
	Doublet b)	33	5	2	6.—	**Batimiento**
81 and 82	Magnifier	10	13	14	6.—	**Batintin**
					5.—	**Batiportas**
83	BRÜCKE dissecting lenses	5	70	20	16.—	**Batochar**
84		5—10	70—60	13—7	25.—	**Batologia**
87	Achromatic Magnifier	3	60	35	12.—	**Batraca**
		5	45	30		
		10	25	15		

Remarks. The magnification is calculated for a normal image distance of 250 mm (10").

The working distance is the distance between the object and the lower surface of the lens, as adjusted by a normal-sighted observer. The distance given above is rather smaller with short-sighted and greater with long-sighted persons.

The same applies to the given linear diameter of the field.

These values are, therefore, only approximate and intended to give merely a rough idea.

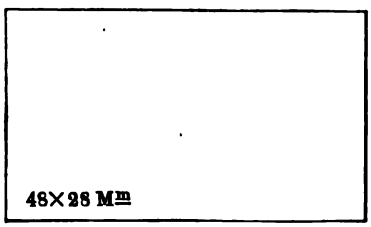
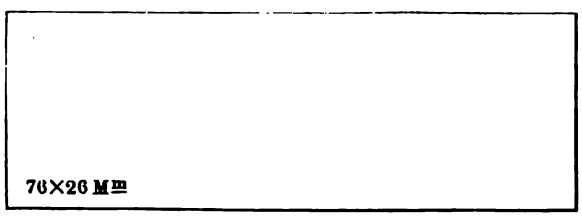
Microtomes. **Within recent years the construction of microtomes has developed to such an extent and many have become so complicated that it is only in workshops specially fitted out for the purpose that they can be turned out successfully and in accordance with the requirements of the day. We have therefore discontinued the manufacture of microtomes entirely, even of our former simple models.**

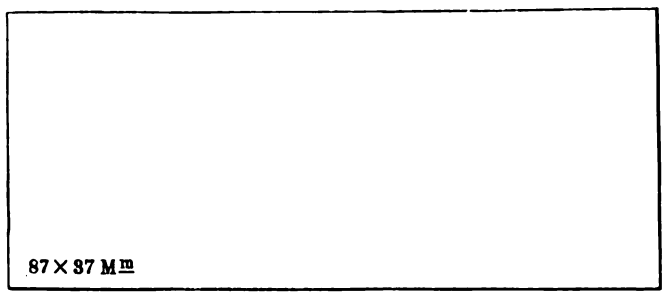
We shall, however, at all times be pleased to obtain from the best sources, as supplements to microscopic outfits purchased from us,

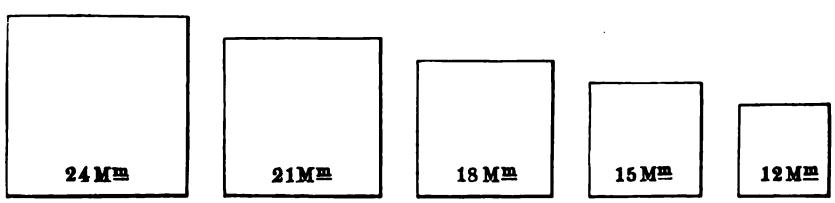
Microtomes,
Cases of Dissecting Instruments,
Microscopic Preparations.

	Prices in Marks. *Code-words.*	
Bell-glasses for covering up microscopes (dust-proof).		
Large size, about 15 × 9½ inches diameter inside	10.—	**Bausan**
Smaller size, about 14 × 8 inches diameter inside	8.—	**Bautismo**
including a stout cloth-covered card-board base.		
Plane ground-glass discs for these bell-glasses, particularly useful for keeping microscopes in damp hot climates in conjunction with chloride of calcium drying appliances. For the large bell-glasses . . .	7.—	**Bautizado**
For the smaller bell-glasses . . .	5.50	**Bavara**

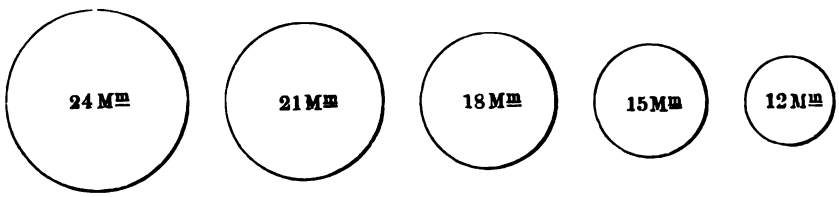
Slides and Cover-glasses.

No.		*Prices in Marks. Code-words.*
93	**Slides of the Giessen size** — 48×28 mm ($1^7/_8 \times 1^1/_8$ inch.)	
		
	a) white crown-glass with ground edges, per 100	3.— **Bayeta**
	b) „ „ „ „ unground edges, per 100	2.— **Bayetilla**
	c) best white plate-glass with ground edges, per 100 . . .	4.— **Bayoneta**
94	**Slides of the English size** — 76×26 mm (3 × 1 in.):	
		
	a) white crown-glass with ground edges, per 100	3.50 **Bazar**
	b) „ „ „ „ unground edges, per 100	2.50 **Bazofia**
	c) best white plate-glass with ground edges, per 100 . . .	7.50 **Beaterio**

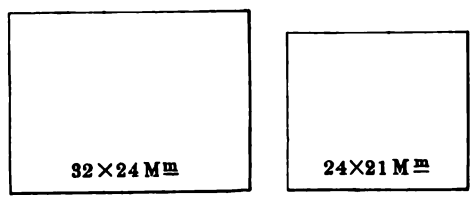
No.		*Prices in Marks. Code-words.*
95	**Slides of extra large size** — 87 × 37 mm:	
		
	a) white crown-glass with ground edges, per 100	5.— **Besito**
	b) „ „ „ „ unground edges, per 100	3.50 **Bestiame**
	c) best white plate-glass with ground edges, per 100 . .	9.— **Bestola**
96	**Hollow Slides:**	
	a) small size, 55 × 32 mm, of best make and finish, ground edges, each	0.50 **Besugo**
	b) extra large, 87 × 37 mm, of best make and finish, edges bevelled and polished, 5 mm thick, each	1.— **Betel**
97	**Slides with cemented glass rings,** for moist chambers 1 or 2 mm deep, each	0.80 **Betun**
98	**Cover-glasses, Squares:**	
	size: 24 mm □ per 100	4.70 **Beut**
	„ 21 „ „ „ 100	3.60 **Bezar**
	„ 18 „ „ „ 100	2.70 **Bezon**
	„ 15 „ „ „ 100	1.80 **Bias**
	„ 12 „ „ „ 100	1.— **Bibir**



No.		*Prices in Marks.* *Code-words.*
99	**Cover-glasses, Circles:**	
	size: 24 mm diameter, per 100	**6.90 Beatifico**
	„ 21 „ „ „ 100	**5.50 Beatilla**
	„ 18 „ „ „ 100	**4.20 Beatitud**
	„ 15 „ „ „ 100	**3.00 Bebanda**
	„ 12 „ „ „ 100	**1.50 Bebedizo**



100	**Cover-glasses, Oblongs:**	
	size: 32 × 24 mm, per 100	**6.00 Becacho**
	„ 24 × 21 „ „ 100	**4.50 Becafigo**



The thickness of the above covers varies between 0.15 and 0.22 mm; one third must be added to the above prices for covers of given thickness.

Complete Microscopes.

For the convenience of intending purchasers we have compiled the following series of suitable and current combinations with the total price appended.

In ordering any of these sets it will be sufficient to quote the respective number and price.

1) Microscope:

Apochromatic objectives:

16.0 mm, 0.30 num. Ap.	8.0 mm, 0.65 num. Ap.	4.0 mm 0.95 num. Ap.		
80.—	100.—	140.—	. . . . . Mk.	320.—
2.5 mm 1.25 num. Ap.	(Water Immers.)			
250.—	. . . . .		„	250.—
2.0 mm, 1.30 num. Ap.	3.0 mm 1.40 num. Ap.	(Homog. Immers.)		
300.—	400.—	. . . . .	„ 700.—	Mk. 1270.—

Compensating Eye-pieces:

2,	4,	8,	12,	18			
20.—	20.—	30.—	30.—	25.—	. . . . .	„	125.—
6 with $^1/_1$ micron divisions (Micrometer Eye-piece No. 29)						„	30.—

Projection Eye-pieces:

2,	4		
40.—	40.—	. . . . .	„ 80.—

Goniometer Eye-piece No. 40a . . . . . „ 50.— „ 285.—

Carried forward Mk. 1555.—

				Code-words.
	Brought forward		Mk. 1555.—	
Apertometer No. 2	Mk.	90.—		
Test-plate No. 3	„	10.—		
Vertical Illuminator No. 104	„	18.—		
Sliding Objective-changer No. 25 with 6 Objective-slides	„	70.—		
Case for 6 slides	„	15.—		
Stage Micrometer No. 26a	„	10.—		
Screw-Micrometer Eye-piece No. 30a	„	105.—		
Stage Screw-Micrometer No. 31	„	120.—		
Cross-line Micrometer No. 32	„	5.—		
Haemacytometer No. 34c	„	36.—		
Measures No. 36 and 37, 100 and 300 mm respectively	„	15.50		
Fully divided circle No. 39, 120 mm dia.	„	15.—		
Cover-glass Gauge No. 41	„	30.—		
Camera No. 44a	„	60.—		
Drawing table No. 105a	„	52.—		
Polariscope No. 48b (Divided Circle being on the Goniometer Eye-piece No. 40)	„	41.—		
Set of Selenite and Mica Films No. 51	„	10.—		
Spectroscopic Eye-piece No. 53	„	200.—		
Erecting Eye-piece No. 57	„	40.—		
Diffraction-plate No. 58 with objective aa and HUYGHENIAN Eye-piece 2	„	54.—		
Microscope Lamp No. 59	„	22.—		
Saccharometer No. 61a	„	108.—		
Turn-table No. 63	„	11.—		
			„ 1137.50	
Price of this outfit together with:				
a) **Stand Ia** and mechanical stage	„	400.—		
Leather case for same	„	30.—		
Packing	„	8.50		
			„ 438.50	Mk. 3131.— **Becerril**
or				
b) **Photo-micrographic stand** fitted with swing-out condenser	„	400.—		
Centring achromatic condenser	„	75.—		
Projection-lenses 35 mm and 70 mm	„	75.—		
Leather case	„	30.—		
Packing	„	8.50		
			„ 588.50	„ 3281.— **Beco**

Accessories for Dissecting and Mounting:

Dissecting Microscope:				
Dissecting Stand I No. 70	„	125.—		
Dissecting Lens No. 76	„	40.—		
Aplanatic Lenses No. 79, 6 and 10 ×, each 18.—	„	36.—		
			„	201.— **Becuna**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

			Code-words.
or			
Greenough's Dissecting Microscope with 2 objectives and			
2 eye-pieces No. 2	Mk. 255.—		
Prism-rotator	„ 72.—		
Capillary rotator	„ 60.—	Mk. 387.—	**Beda**
or			
Drüner-Braus's Dissecting Stand with 2 objectives and			
2 eye-pieces No. 2	„ 340.—		
Dissecting Stand I, No. 70	„ 125.—		
Combination Dissecting Lens No. 76	„ 40.—		
Aplanatic Lenses No. 79, 6 and 10×, each Mk. 18.— . .	„ 36.—		
Prism-rotator	„ 72.—		
Capillary rotator	„ 60.—		
Lens-holder I No. 74	„ 40.—		
with BRÜCKE Lenses Nos. 83 and 84	„ 41.—	„ 754.—	**Bedilla**

2) Microscope:

Apochromatic Objectives:

16.0 mm, 0.30 num. Ap.	8.0 mm, 0.65 num. Ap.	3.0 mm 0.95 num. Ap.			
80.—	100.—	160.—	„ 340.—		
2.5 mm (Water Immers.) 1.25 num. Ap.					
250.—			„ 250.—		
1.5 mm (Homog. Immers.) 1.30 num. Ap.					
350.—			„ 350.—	Mk. 940.—	

Compensating eye-pieces:

2,	4,	8,	12,	18			
20.—	20.—	30.—	30.—	25.—	„ 125.—		
6 with $^1/_1$ micron divisions (micrometer eye-piece No. 29)					„ 30.—	„ 155.—	
Apertometer No. 1					„ 70.—		
Test-plate No. 3					„ 10.—		
Revolving Nose-piece No. 24c					„ 32.—		
Stage-micrometer No. 26a					„ 10.—		
Cover-glass gauge No. 41					„ 30.—		
Drawing-apparatus No. 44a					„ 60.—		
Drawing-table No. 105					„ 45.—		
Polarizing Apparatus No. 48a					„ 58.—		
Set of selenite and mica films No. 51					„ 10.—	„ 325.—	
Price of the above outfit together with							
a) **Stand Ia** with mechanical stage					„ 400.—		
				Packing	„ 4.—	„ 404.—	„ 1824.— **Beeno**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

				Code-words.
b) **Photo-micrographic stand** with swing-out condenser	Mk. 400.—			
Packing	„ 4.—	Mk. 404.—	Mk. 1824.—	**Befar**
c) **Stand II^a** with swing-out condenser	„ 315.—			
Attachable **mechanical stage** No. 64	„ 85.—			
Packing	„ 4.—	„ 404.—	„ 1824.—	**Begardo**

***Dissecting Appliances** suitable to complete this outfit:*

Dissecting microscope, consisting of:			
Dissecting Stand I No. 70	„ 125.—		
Dissecting lens No. 76	„ 40.—		
Aplanatic lenses No. 79, 6 and 10×, each Mk. 18.—	„ 36.—	„	201.— **Beguer**

3) Microscope:

Apochromatic Objectives:

16.0 mm / 0.30 num. Ap.	8.0 mm / 0.65 num. Ap.	4.0 mm / 0.95 num. Ap.			
80.—	100.—	140.—	„ 320.—		
2.0 mm / 1.40 num. Ap.	(homog. Immersion)	(or 3.0 mm / 1.40 num. Ap.) . .	„ 400.—	„ 720.—	

Compensating eye-pieces:

2,	4,	8,	12,				
20.—	20.—	30.—	30.—	„ 100.—			
6 with $^1/_1$ micron divisions (micrometer eye-piece No. 29)				„ 30.—	„ 130.—		
Sliding objective-changers No. 25 with 4 objective-slides				„ 50.—			
Case for 6 sliding changers				„ 15.—			
Drawing Apparatus No. 44^a				„ 60.—			
Polarizing Apparatus No. 48^a				„ 58.—			
Test-plate No. 3				„ 10.—	„ 193.—		

Price of the above outfit including

a) **Stand I^a** with mechanical stage	„ 400.—			
Packing	„ 3.50	„ 403.50	„ 1446.50	**Behen**
b) **Photo-micrographic stand** with swing-out condenser	„ 400.—			
Packing	„ 3.50	„ 403.50	„ 1446.50	**Belso**
c) **Stand II^a** with swing-out condenser	„ 315.—			
Attachable **mechanical stage** No. 64	„ 85.—			
Packing	„ 3.50	„ 403.50	„ 1446.50	**Bejuco**

*Suitable **Accessories for Dissecting and Mounting:***

Dissecting microscope:			
Dissecting Stand III No. 71	„ 70.—		
Dissecting lens No. 76	„ 40.—		
Aplanatic lenses No. 79, 6 and 10×, each Mk. 18.—	„ 36.—		
Special carrier for adaptation of these lenses to dissecting stand III	„ 4.—		
Lens-Holder I No. 74	„ 40.—		
with BRÜCKE lens No. 83	„ 16.—	„	206.— **Belcho**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

4) Microscope: *Code-words.*

Apochromatic Objectives:

16.0 mm	8.0 mm	4.0 mm				
0.30 num. Ap.	0.65 num. Ap.	0.95 num. Ap.				
80.—	100.—	140.—	. . . . .	Mk.	320.—	
2.0 mm	(homog. Immers.)					
1.30 num. Ap.			. . . . .	„	300.—	

Compensating eye-pieces:

2,	4,	8,	12					
20.—	20.—	30.—	30.—	. . . . .	„	100.—		
6 with $^1/_1$ micron divisions (micrometer eye-piece No. 29)					„	30.—	Mk.	750.—
Sliding objective-changers No. 25 with 4 objective-slides				. .	„	50.—		
Case for 6 sliding changers				. . . . .	„	15.—		
Stage-Micrometer No. 26a				. . . . .	„	10.—		
Drawing-apparatus No. 44a				. . . . .	„	60.—		
Test-plate No. 3				. . . . .	„	10.—	„	145.—

Price of the above outfit including:

a) **Stand Ia** with mechanical stage	„	400.—				
Packing	„	3.50	„	403.50	Mk. 1298.50	**Belen**
b) **Stand IIa** with swing-out condenser	„	315.—				
Attachable **mechanical stage** No. 64	„	85.—				
Packing	„	3.—	„	403.—	„ 1298.—	**Belerico**
c) **Stand IVa** with swing-out condenser	„	275.—				
Attachable mechanical stage	„	85.—				
Packing	„	3.—	„	363.—	„ 1258.—	**Belhez**

5) Microscope *(for mineralogical and crystallographic investigations).*

Achromatic objectives:

a²,	AA,	DD,	F				
12.—	30.—	54.—	84.—	. . . . .	„	180.—	
$^{1}/_{12}$	1.25 num. Aperture (homog. Immersion)			. . . .	„	160.—	
Huyghenian eye-pieces:							
1, 2, 4 with cross lines, each Mk. 10.—				. . . . .	„	30.—	
3 with micrometer (micrometer eye-piece No. 28)				. . .	„	18.—	
Quadruple revolving nose-piece No. 24c				. . . . .	„	32.—	
Drawing-apparatus No. 44				. . . . .	„	35.—	
Iris-diaphragm with eye-piece No. 52				. . . . .	„	25.—	
Set of **selenite and mica films**				. . . . .	„	10.—	
Bertrand eye-piece				. . . . .	„	35.—	
Stauroscopic-plate				. . . . .	„	7.—	Mk. 532.—

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

					Code-words.
Price of above outfit together with:					
a) **Mineralogical Stand** with swing-out condenser . .	Mk. 575.—				
Goniometer eye-piece without divided circle (this being part of the stand)	„ 15.—				
Packing	„ 4.—	Mk. 594.—	Mk. **1126.**—		**Belido**
b) **Stand I^a** with divided solid vulcanite stage, without mechanical stage	„ 340.—				
Goniometer eye-piece No. 40	„ 30.—				
Polarizing Apparatus No. 48^b	„ 41.—				
Eye-piece No. 50 **for observing axial images**	„ 30.—				
Packing	„ 4.—	„ 445.—	„ **977.**—		**Bellili**

6) *Microscope (as adapted by the Prussian Military Hospitals).*

Achromatic dry lenses:					
AA, DD					
30.— 54.—	„ 84.—				
Apochromatic Homogeneous Immersion Lens:					
2.0 mm / 1.30 num. Ap.	„ 300.—				
Huyghenian eye-pieces:					
2, 4 . . . . . each Mk. 7.—	„ 14.—				
Compensating eye-pieces:					
4, 8 / 20.— 30.—	„ 50.—				
6 with $^1/_1$ micron divisions (micrometer eye-piece No. 29)	„ 30.—				
Revolving Nose-piece No. 24^b	„ 27.—	„ 505.—			
Price of the above outfit together with:					
a) **Stand I^a** without mechanical stage	„ 325.—				
Leather case	„ 30.—				
Packing	„ 3.—	„ 358.—	„ **863.**—		**Bella**
b) **Stand II^a** with swing-out condenser	„ 315.—				
Leather case	„ 26.—				
Packing	„ 2.—	„ 343.—	„ **848.**—		**Belleguin**
c) **Stand IV^a** with swing-out condenser	„ 275.—				
Attachable **mechanical stage** No. 64	„ 85.—				
Leather case	„ 26.—				
Packing	„ 2.—	„ 388.—	„ **893.**—		**Bellido**

We recommend the addition of a **Test-plate**, No. 3 price Mk. 10.—, which may be ordered separately.

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

7) Microscope *(particularly suitable for the purposes of medical practitioners and veterinary surgeons).* — *Code-words.*

Achromatic objectives:

AA,	DD					
30.—	54.—	. . . . .	Mk.	84.—		
I/12		1.25 num. Ap. (homogeneous immersion)	„	160.—		
Huyghenian eye-pieces:						
2, 4		. . . . . each	Mk. 7.—	„ 14.—		
Revolving Nose-piece No. 24b		. . . . .	„	27.—	Mk. 285.—	

Price of the above, which may be described as the minimum outfit required for bacteriological research, together with:

a) **Stand Ia** without mechanical stage	„	325.—				
Packing	„	3.—	„ 328.—	Mk.	613.—	**Bellota**
b) **Stand IIa** with swing-out condenser	„	315.—				
Packing	„	2.—	„ 317.—	„	602.—	**Bemol**
c) **Stand IVa** with swing-out condenser	„	275.—				
Packing	„	2.—	„ 277.—	„	562.—	**Ben**

8) Microscope *(for similar purposes, but cheaper than outfit 7):*

Achromatic objectives:

A,	D					
24.—	42.—	. . . . .	„	66.—		
I/12		1.25 num. Ap. (homogeneous immersion)	„	160.—		
Huyghenian eye-pieces:						
2, 4		. . . . . each	Mk. 7.—	„ 14.—		
Revolving Nose-piece No. 24b		. . . . .	„	27.—	„ 267.—	

Price of the above outfit together with:

a) **Stand Ia** without mechanical stage	„	325.—				
Packing	„	3.—	„ 328.—	„	595.—	**Benari**
b) **Stand IIa** with ordinary condenser	„	290.—				
Packing	„	2.—	„ 292.—	„	559.—	**Bendicion**
c) **Stand IVa** with ordinary condenser	„	250.—				
Packing	„	2.—	„ 252.—	„	519.—	**Benecir**
d) **Stand IVb** with illuminating apparatus No. 18 . .	„	200.—				
Packing	„	2.—	„ 202.—	„	469.—	**Benedicto**
e) **Stand VIa** with illuminating apparatus No. 19 .	„	150.—				
Packing	„	2.—	„ 152.—	„	419.—	**Beneficiar**

Outfit 8e) has been recommended by Prof. JOHNE as a travelling microscope.

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

9) Microscope *(particularly adapted for botanical and zoological investigations):* — *Code-words.*

Achromatic objectives:

a²,	**A,**	**C,**	**E**						
12.—	24.—	36.—	66.—	. . . . .	Mk.	138.—			
Water-immersion lenses:									
D*,	**J**								
75.—	144.—	. . . . .			„	219.—			
Huyghenian eye-pieces:									
2, 4	. . . . .			each Mk.	7.—	„	14.—		
3 with eye-piece micrometer (Micrometer eye-piece No. 28)						„	18.—		
Revolving Nose-piece No. 24ᵇ	. . . . .					„	27.—		
Drawing-apparatus No. 44ᵃ	. . . . .					„	60.—	Mk. 476.—	
Price of the above outfit together with:									
a) **Stand Iᵃ** without mechanical stage	. . . . .					„	325.—		
				Packing		„	3.—	„ 328.—	Mk. 804.— **Benelto**
b) **Stand IIᵃ** with swing-out condenser	. . . . .					„	315.—		
				Packing		„	2.—	„ 317.—	„ 798.— **Benfecho**
c) **Stand IVᵃ** with swing-out condenser	. . . . .					„	275.—		
				Packing		„	2.—	„ 277.—	„ 758.— **Benigno**
d) **Stand VIᵃ** with illuminating apparatus No. 19	.					„	150.—		
				Packing		„	2.—	„ 152.—	„ 628.— **Benjamin**
This outfit may be completed by the addition of our									
Achromatic oil-immersion lens $^1/_{12}$ 1.25 n. Ap.	. . . .								„ 160.— **Bagatela**

10) Microscope *(for similar purposes but of a cheaper equipment than outfit 9).*

Achromatic dry lenses:

a*,	**A,**	**D,**	**F**						
40.—	24.—	42.—	84.—	. . . . .		„	190.—		
Huyghenian eye-pieces:									
2, 4	. . . . .			. each Mk.	7.—	„	14.—		
Revolving Nose-piece No. 24ᵇ	. . . . .					„	27.—	„ 231.—	
Price of the above outfit together with:									
a) **Stand IVᵃ** with ordinary condenser	. . . . .					„	250.—		
				Packing		„	1.80	„ 251.80	„ 482.80 **Beodo**
b) **Stand VIᵃ** with illuminating apparatus No. 19	.					„	150.—		
				Packing		„	1.—	„ 151.—	„ 382.— **Ber**
This outfit may be completed by the addition of our									
Achromatic oil-immersion lens $^1/_{12}$ 1.25 n. Ap.									„ 160.— **Bagatela**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

11) Microscope *(particularly adapted for breweries; sufficient for advanced investigations).* — *Code-words.*

Achromatic objectives:

A, C, E

24.— 36.— 66.— . . . . . Mk. 126.—

$\frac{1}{12}$ 1.25 num. Ap. (homog. immersion) . . . . . „ 160.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.—

3 with micrometer (micrometer eye-piece No. 28) . . . „ 18.—

Counting-chamber No. 33 . . . . . „ 15.—

Revolving nose-piece No. 24c für 4 lenses . . . . . „ 32.— Mk. 365.—

Price of the above outfit together with:

a) **Stand Ia** with mechanical stage . . . . . „ 400.—

Packing „ 3.— „ 403.— Mk. **768.—** **Berbiqui**

b) **Stand IVa** with swing-out condenser . . . . . „ 275.—

Attachable mechanical stage No. 64 . . . . . „ 85.—

Packing „ 2.50 „ 362.50 „ **727.50** **Bergama**

12) Microscope *(for similar purposes but cheaper than outfit 11).*

Achromatic objectives:

A, D, F

24.— 42.— 84.— . . . . . „ 150.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.—

Counting-chamber No. 33 . . . . . „ 15.— „ 179.—

Price of the above outfit together with:

a) **Stand VIa** with illuminator No. 19 . . . . . „ 150.—

Packing „ 1.20 „ 151.20 „ **330.20** **Berganton**

b) **Stand VII** with illuminator No. 19 . . . . . „ 100.—

Packing „ 1.20 „ 101.20 „ **280.20** **Berilo**

13) Microscope *(particularly adapted for industrial purposes, such as paper and celluloid manufacture, customs examination of silk, wool, cotton etc.).*

Achromatic objectives:

a², A, D

12.— 24.— 42.— . . . . . „ 78.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.—

Polarizing apparatus No. 49b . . . . . „ 44.— „ 136.—

Price of the above outfit together with:

a) **Stand VIa** with **iris-diaphragm** . . . . . „ 136.—

Packing „ 1.20 „ 137.20 „ **273.20** **Bernegal**

b) **Stand VII** with ordinary cylinder-diaphragm . . . „ 80.—

Packing „ 1.— „ 81.— „ **217.—** **Berra**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

14) Microscope *for histological, zoological and botanical courses.* *Code-words.*

Achromatic objectives:

A, C, E

24.— 36.— 66.— . . . . . Mk. 126.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.— Mk. 140.—

Price of the above outfit together with:

a) **Stand VI[a]** with illuminator No. 19 . . . . . „ 150.—

Packing „ 1.20 „ 151.20 Mk. **291.20** **Berma**

b) **Stand VII** with illuminator No. 19 . . . . . „ 100.—

Packing „ 1.20 „ 101.20 „ **241.20** **Bermejo**

c) **Stand VII** with cylinder-diaphragm . . . . . „ 80.—

Packing „ 1.20 „ 81.20 „ **221.20** **Bermuda**

15) Microscope *for similar purposes, but cheaper:*

Achromatic objectives:

a^2, B, D

12.— 30.— 42.— . . . . . „ 84.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.— „ 98.—

Price of the above outfit together with:

a) **Stand VI[a]** with illuminator No. 19 . . . . . „ 150.—

Packing „ 1.20 „ 151.20 „ **249.20** **Berrendo**

b) **Stand VII** with cylinder-diaphragm . . . . . „ 80.—

Packing „ 1.— „ 81.— „ **179.—** **Berrizal**

16) Microscope *for similar purposes, inexpensive combination:*

Achromatic objectives:

A, D

24.— 42.— . . . . . „ 66.—

Huyghenian eye-pieces:

2, 4 . . . . . each Mk. 7.— „ 14.— „ 80.—

Price of the above outfit together with:

a) **Stand VI[a]** with ordinary cylinder-diaphragm . . . „ 130.—

Packing „ 1.20 „ 131.20 „ **211.20** **Berruga**

b) **Stand VII** with cylinder-diaphragm . . . . . „ 80.—

Packing „ 1.— „ 81.— „ **161.—** **Bervete**

17) Trichinoscope. *Prof. JOHNE's outfit.*

Stand IX with specially constructed triple objective and 2 eye-pieces; 6 magnifications of 30 to 190 . . . . „ 80.—

Packing „ 1.20

„ **81.20** **Besador**

In the event of a microtome being included in the specification we shall be pleased to supply it at the maker's catalogue price (see notice on p. 108).

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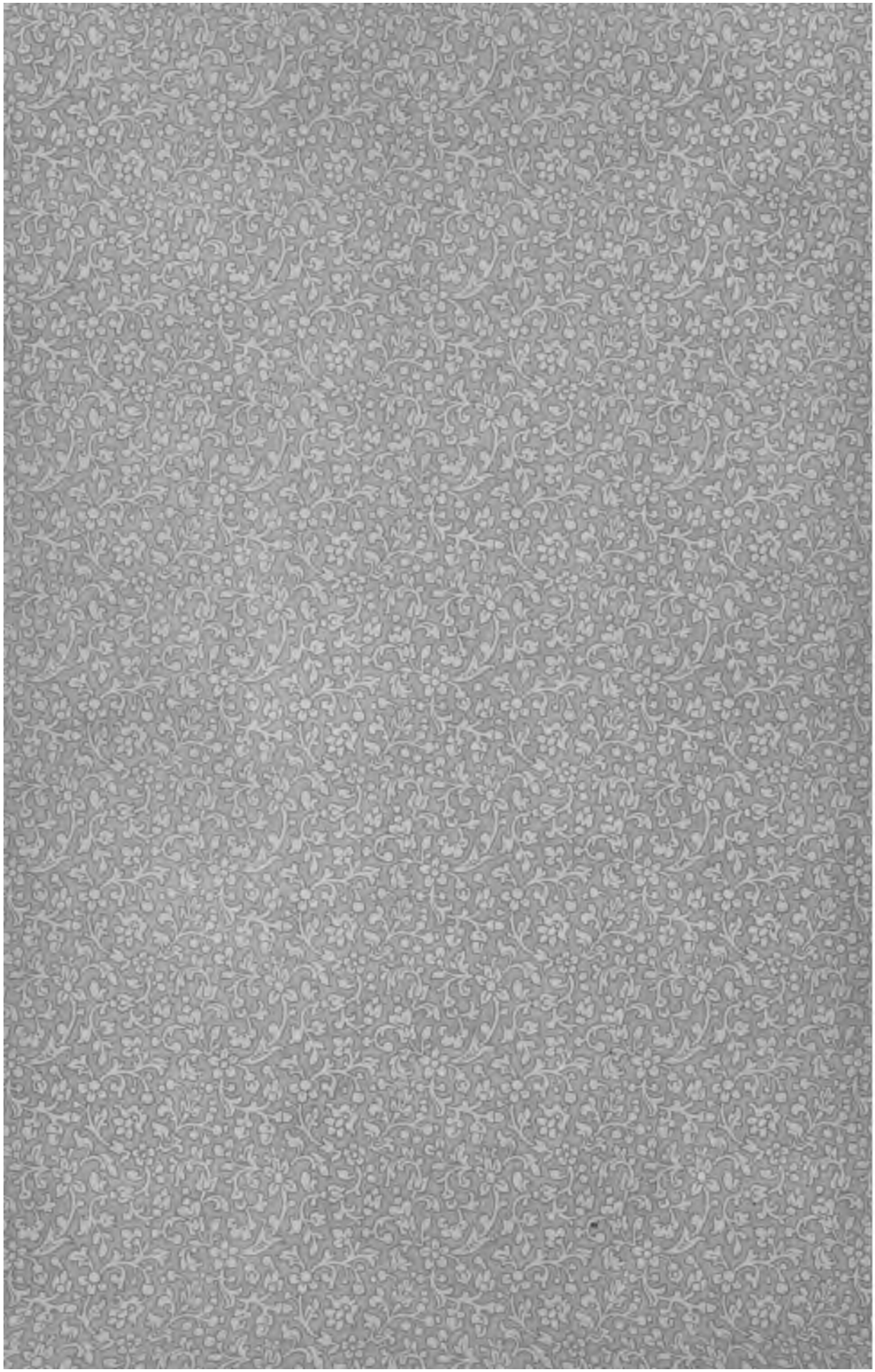

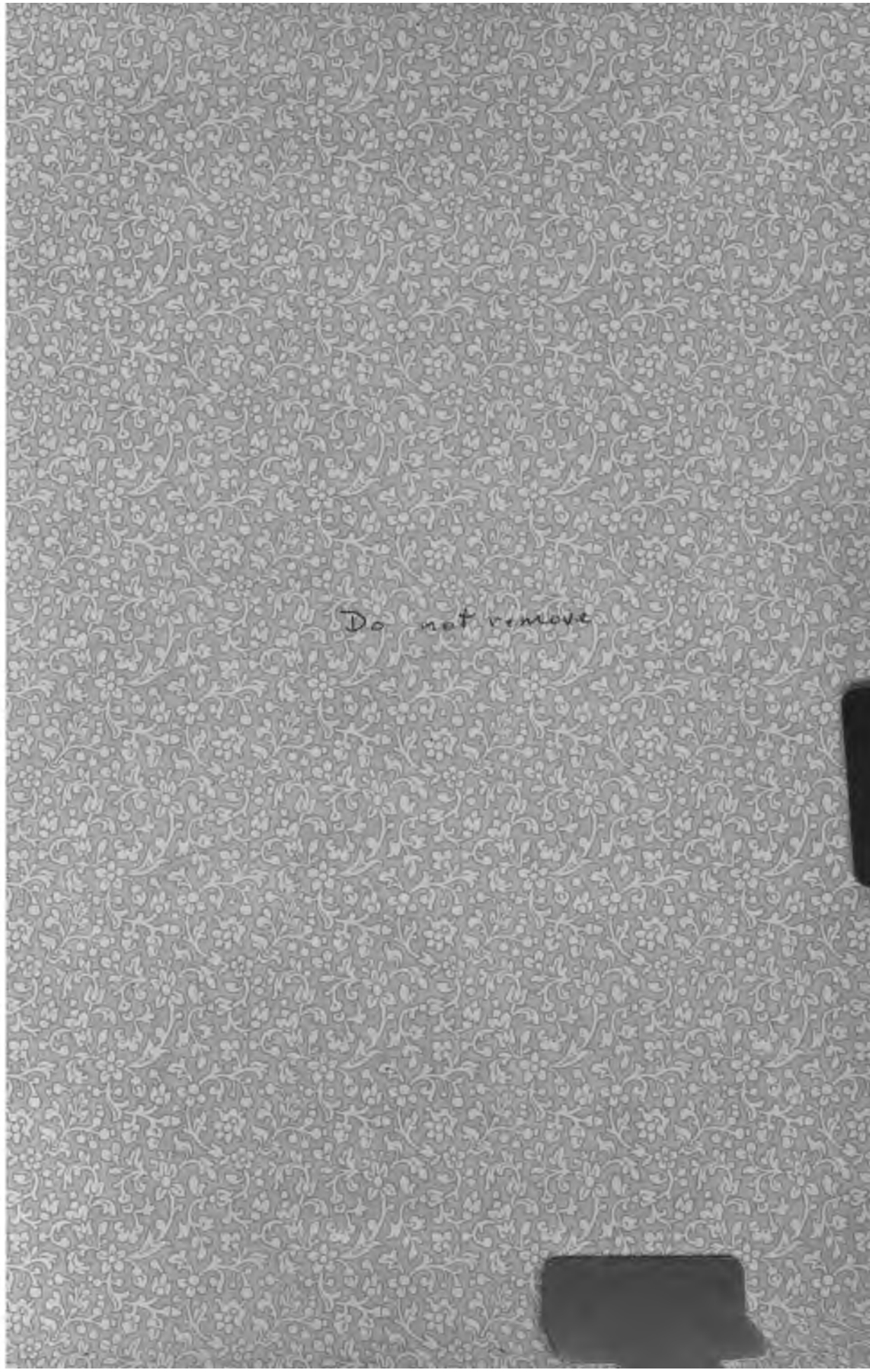
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